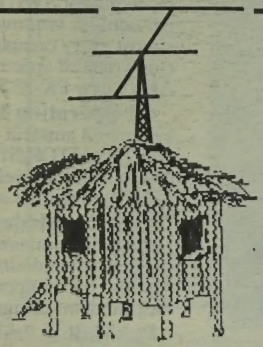
Digital Digest

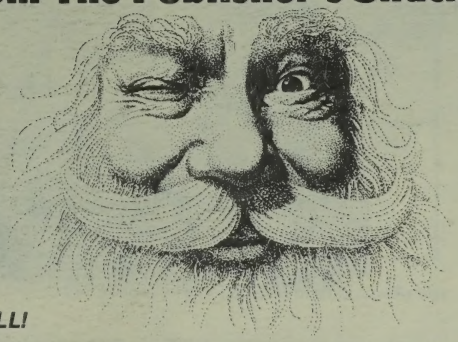
Vol. 2 No. 6 **Devoted entirely to Digital Amateur Radio Communications** November/December, 1989

In This Issue:

There's all this, and a whole lot more in this issue!



From The Publisher's Shack



SEASON'S GREETINGS TO ALL!

This is an especially poignant time for us at D-D as this issue marks our first complete year of publication.

It has been a mixed bag of thrills and chills to be on the ground floor of a new publication and watch it's development through this past year. Over the year, we have attempted to broaden the publication's appeal with more articles and pages devoted to amateur digital communications. We have also published material that should be of interest to those computer hobbyists, and to our amateur peers who have not yet been bitten by the "digital bug."

Much of the gratification in publishing D-D over this past year has come from you, our readers, who have responded so favorably to the Digest. Gratifying also, has been the growing support we have received from the manufacturing segment of our amateur community.

Looking ahead to 1990, and a new decade... the best, we feel, of Digital Digest and for amateur radio is yet to come. We will continue to "fine-tune" the publication to provide you with all the news and information you can use as the technologies of the '90's bring new challenges and opportunities to amateur radio and digital communications.

Thanks to all of you who have subscribed to; advertised in; and written for the Digest over this past year... We wish you the best the holiday season has to offer and look forward to seeing you all again next year!

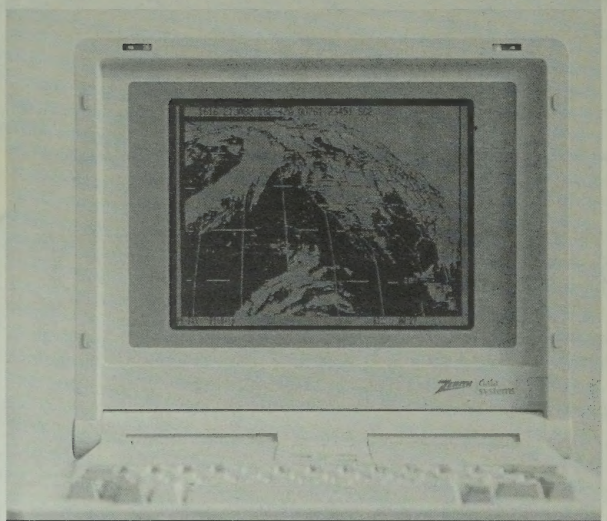
73, Tom / WA8DXD

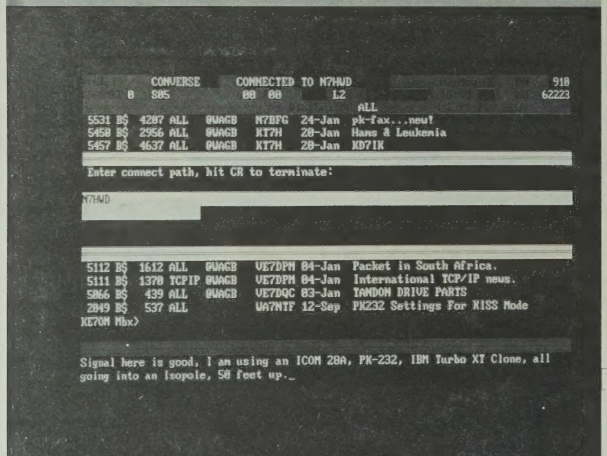
Digital Digest
Devoted entirely to Digital Radio Communications
4063 N. Goldenrod Road • Winter Park, Florida 32792

Steven K. Stroh / N8GNJ / 90-5
14919 NE 163rd Street
Woodinville, WA 98072-8957

PRICE: **$2.75**

AEA's NEW PK-232MBX With PakMail™





Now AEA's popular PK-232 multi-mode data controller has new features you've been asking for...PakMail™ Mailbox with selectable third-party traffic, seven-character AMTOR (CCIR R.625) call identity, TDM (Time Division Multiplex) receiving for SWL's, and Prioritized Acknowledgement (ACK) protocol for improved packet performance. Compatible with almost every computer or asynchronous data terminal, you can enjoy the full spectrum of amateur digital communications with AEA's new PK-232MBX.

All Operating Modes. The PK-232MBX includes all authorized amateur digital modes available today...Morse, Baudot, ASCII, AMTOR/SITOR 476 and 625, Packet, WEFAX receive and transmit, as well as commercial standard NAVTEX automated marine information services.

Superior Modem. An eight-pole Chebyshev bandpass filter limiter- discriminator modem improves the signal-to-noise ratio at the detector and virtually eliminates interference from adjacent signals. System performance has been proven superior to that of PLL modems designed for telephone line services.

PakMail.™ PakMail™ mailbox with selective control of third-party traffic is now a standard feature. Your friends can now leave you messages around the clock. Your local full-service BBS can automatically forward your messages directly to your PK-232MBX.

WEFAX Transmission and Reception. AEA brought you the first multi-mode controller to send and receive WEFAX (weather facsimile) charts. The PK-232MBX directly supports the widest range of printers on the market using the optional RS-232/printer cable.

Host Mode. Only AEA provides the type of full-featured Host Mode preferred by many professional programmers for efficient control of the PK-232MBX. AEA's Host Mode programs include PC-Pakratt with FAX for the IBM PC's and compatible MS-DOS computers, COM- Pakratt with FAX for the Commodore C-64 and C-128, and now MacRATT with FAX for the Apple Mac-Intosh.

Two Radio Ports. Independent radio connection ports allow convenient, interchangeable all-mode operation regardless of port selection. You can connect two VHF/UHF radios, an HF and a VHF/UHF radio, or two HF radios, selectable by a front-panel switch.

Signal Analysis. The PK-232MBX's internal software features AEA's exclusive SIAM (Signal Identification and Acquisition Mode). The PK-232MBX automatically identifies Baudot, ASCII, AMTOR/SITOR and TDM signals, then measures signal speed and polarity. A simple "OK" command automatically switches the PK-232MBX to the recognized mode and starts the data display.

PakMail™ Upgrade Kit. The easily-installed PakMail™ upgrade kit includes a plug-in board and new software EPROMs, and is fully compatible with all existing PK-232's. Please contact factory for details.

You Deserve The Original. AEA produced the first multi-mode data controller. The PK-232 continues to be the standard against which all other multi-mode controllers are judged; the choice of critical amateurs, commercial services and government agencies. Don't settle for less than the best.

AEA Brings You A Better Experience.

Advanced Electronic Applications, Inc.
2006-196th St. SW/P.O. Box 2160
Lynnwood, WA 98036
206-775-7373

Kantronics...

is now shipping three computer programs on one disk for the IBM PC (and compatibles) and the Commodore C-64 and C-128 computers. Th "PC Combo" includes Kanterm-PC, Pacterm-PC and Superfax. The "64/128 Combo" includes Kanterm-64/128, Pacterm-64 and MaxFax. Kanterm is a general purpose terminal program that is optimized for use with the Kantronics line of data controllers. Pacterm is a packet-radio terminal program that is optimized for use with the Kantronics line of TNC's. Superfax and MaxFax are facsimile (FAX) programs that are optimized for use with the Kantronics line of data controllers. Previously, each program was sold separately. The two Kantronics software combos retail for $49.95 each. For more information, contact: Kantronics, 1202 E. 23rd Street, Lawrence, KS 66046.

New Software Releases...

AA4RE's BB, Version 2.7, a PBBS for IBM PC and compatible computers is available for downloading from CompuServe's HamNet data library 9 (DL9), COYnet Landline BBS (914-485-3393), Pleasant Valley Phone BBS (508-688-1348), and WA6RDH's telephone BBS (916-678-1535), or it is available on disk from TAPR (PO Box 12925, Tucson, AZ 85732).

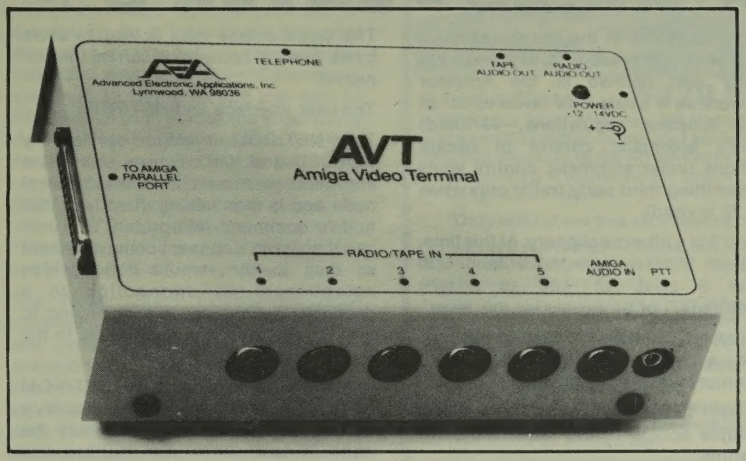
G3ZCZ's LAN-LINK, Version 1.54, a terminal program for the IBM PC and compatible computers with multimode controllers/TNC's is available for downloading from CompuServe's HamNet data library 9 (DL9).

G8BPQ's TheNode, Version 3.51, networking software for IBM PC and compatible computers is available for downloading from CompuServe's HamNet data library 9 (DL9), and Pleasant Valley Phone BBS (508-6881348). R95, Version 1.2, a binary to data text conversion utility for IBM PC and compatible computers is available from Texas Packet Software (PO Box 50106, Denton, TX 76206).

W0RLI Mailbox, Version 11.4, a PBBS for IBM PC and compatible computers is available for downloading from CompuServe's HamNet data library 9 (DL9), N1EDF's telephone BBS (5089493590), Pleasant Valley Phone BBS (508-688-1348), VE3GYQ's telephone BBS (519-6601442) or it is available on disk from TAPR (PO Box 12925, Tucson, AZ 85732). (File name FS1104.EXE is the fast upgrade for those who already have Version 11.2, while the file name MB1104.EXE is the full-blown version.)

Source: Gateway

AEA Releases SSTV and FAX System for the AMIGA...



Advanced Electronic Applications, Inc. (AEA) recently released its Commodore Amiga Video Terminal (AVT) system.

Developed by Ben Blish (Williams) AA7AS and Dr. Anne Williams N7LWZ, the AVT system utilizes the unique graphics capabilities of the Amiga to transmit and receive high resolution facsimile and slow-scan television images. Received images can be printed on any Amiga printer or saved on a disk file.

A unique capability of the AVT mode is the 400 Hz bandwidth, instead of the conventional 1100 or 1200 Hz SSTV bandwidths. If used in conjunction with a CW filter and IF shift, this drastically improves the signal-to-noise ratio enabling clearer reception of weak signals. Further, all video information is crystal-locked at both the transmitting and receiving stations at the start of each frame eliminating misalignment.

Another unique feature of the AVT system is its ability to send high speed color images over telephone lines to similarly equipped AVT system stations. There's also telephone ring detect and auto answer. The benefits of the AVT system for SSTV include:

• The ability to get through when no other SSTV mode can • Effectively enhances reception • Removes color/luma phase and position errors • Provides full-color images • Resists QRM and QRN • Offers higher resolution than any other SSTV mode in use to date

The AVT system is now available through AEA authorized dealers at an Amateur Net price of $299.95. For more information, contact your local dealer or AEA, P.O. Box C2160, Lynnwood, WA 98036-0918 / Telephone: (206) 775-7373

Is It Time To Renew Your Subscription!?

Be sure to check your mailing label for your subscription's expiration date. Expiration is indicated by the digits to the right side of your name by YEAR-ISSUE#. Issues are numbered 1 through 6 and relates to the publication as follows:

(1)Jan/Feb, (2)Mar/Apr, (3)May/Jun, (4)Jul/Aug, (5)Sep/Oct (6)Nov/Dec.

EXAMPLE: If your mailing label has the digits "89-6", your subscription will expire in 1989 with the Nov/Dec issue. To insure uninterrupted service, be sure to mail in your renewal before mailing of the next issue (approx. the 25th of the first month's issue date - ex: Jan/Feb is mailed on the 25th of January).

Digital Digest
PACKET

by Lynn W. Taylor, WB6UUT
463 Myrtle Street • Laguna Beach, CA 92651

★ AX.25 - LAYER 3 ★

Our discussions in the last three issues have been pretty easy. Layer 1 and 2 are pretty well defined in the Amateur network as it exists now (even as far as U.S. Amateur regulations, 97.109(d) allows automatic control of packet stations under automatic control while transmitting third party traffic only when AX.25 is used).

Layer 3 is a bit more slippery. At this time, at least 3 different implementations of layer 3 exist, as well as dozens (hundreds?) of proposals for this layer.

At layer 1, we have radios and modems and a way for one station to communicate with another.

At layer 2, we add error correction and multiple access to the physical (radio) channel.

In a theoretical layer 3 we add two new capabilities: routing and congestion control.

AX.25 layer 2 contains some crude layer 3 functions in the form of "digipeating," but this capability falls well short of what is desired at layer 3.

When a layer 3 user establishes a connection, he specifies the destination node only, and the network figures out how to reach that end station. The user does not need to know the intermediate stations — in fact may not be able to find out how his packets are routed at all.

Congestion control is also simple in concept. When one or more nodes in the network become "overloaded" they tell their neighbor nodes to "slow down" until they can get rid of their current frames. In some layer 3 networks, congestion control works with routing; if one station or one area is congested, other traffic is routed around the blockage.

In addition to the above two issues, we must also consider the user interface: how do existing packet stations use the new facilities at layer three?

The user interface and ROSE:

One of the current layer 3 implementations is ROSE (RATS Open Systems Environment). A ROSE network mimics the layer 2 network by redefining the first two digipeater addresses: the first address specifies the entry node, while the second specifies the destination. All the user really needs to know is how to set up a two-hop digipeat and the area code and exchange number of the destination station. In a theoretical west coast network, typing "C WB6UUT via LAX, 714497" would connect to me.

The disadvantage here is that 14 extra bytes (the full address) is carried in each packet.

The user interface and NET/ROM:

The NET/ROM system, devised by WA8DED and W6IXU, uses a different approach: each user connects to his local node and is then talking directly to that node's command interpreter. The user can then issue a connect command (sent as data to the remote node) which establishes the connection to a destination, then issues a command to the remote node which connects to the destination station.

In addition to callsigns, each NET/ROM node also has an alias, which is usually a unique identifier which tells where the node is located. If user stations use identifiers rather than node callsigns, it is immediately apparent that they are trying to reach another NET/ROM station rather than a user on the local channel.

In addition to the connect command, users may inspect the parameter and routing tables on the node, call CQ, etc.

This three step process is a little harder for the user, but results in less overhead.

Routing in ROSE:

In order to perform the routing function, each station in the network must contain a routing table. The ROSE network uses a static-table routing system where each node's table is constructed by the node operator and uploaded to the node.

There are two advantages to this approach: first, since most layer 3 networks are running on limited hardware, larger, "ground based" computers, often with the help of human operators can work to provide optimum tables. Additionally, the network can make use of known solid paths.

Routing and NET/ROM:

NET/ROM nodes use an automatic routing system: each node broadcasts it's identity, and a list of stations it knows how to reach. Other NET/ROM stations listening to the channel hear the hourly broadcast and build their own tables based on these other broadcasts.

In addition to the callsign and alias, each entry contains a "path quality" which is calculated based on the port quality for this connection and the port quality of all other connections used.

In this way, each node will select the "best" path by selecting the one with the highest quality.

Note that in all layer 3 networks, "best" is not necessarily "shortest" and a NET/ROM node operator can adjust the port quality to favor some ports over others: by lowering the port quality on a 2 meter port, for example, the node operator can cause a backbone connection to be used whenever possible.

NET/ROM does have problems when propagation is variable: a few hours of good propagation can cause extra overhead for hours afterwards while nodes in one area try to connect direct to nodes in another area which are no longer reachable.

Congestion control:

NET/ROM does some congestion control with user stations: when the channel is busy and one user is providing most of the loading, RNR frames are sent to "hold off" that station. Since most stations assume that the matching RR frame may have been missed when the FRACK timer runs out, this is of limited effectiveness.

Neither ROSE or NET/ROM will route around congested areas, so this feature is not used in either of the current popular layer 3 networks.

Other layer 3 projects:

The biggest single problem with our current layer 3 networks is a hardware problem. Both ROSE and NET/ROM are designed to run on normal, TNC-2 like devices.

N6NKF, KA6IQA and WB6HHV have attempted to solve the hardware problem by designing the PS-186, a four port, high performance network switch. Prototypes have been running, and agreements have been made which could lead to production of this device, a lack of firmware and development tools has hindered development.

Similarly, the TAPR NNC is also waiting for developers to design and implement appropriate networking firmware to run on this device.

Higher platforms, such as the IBM PC are available relatively inexpensively, and should someday provide the network we are looking for. The current implementations of TCP/IP (which is not based on the ISO model) run on larger microcomputers, but many have been reluctant to put this kind of hardware in the relatively harsh mountaintop environments needed for long-range linking.

Finally, we have been hindered by a lot of people talking about network standards, routing strategies, "adequate" hardware and not enough actual implementation.

(cont'd on next page)

(cont'd from previous page)

Setting standards at higher levels will depend on getting things running on real hardware, and into enough sites to build a real network.

Next issue we will step beyond layer 3 and take a quick look at layers 4-7.

Microsat Testing Continues For January Launch...

Bob McGwier, N4HY, and Doug Loughmiller, KO51, spent an entire week performing software and hardware testing of the four AMSAT MicroSats (PACSAT, LUSAT, DOVE, and WEBERSAT), which are now scheduled for launch in January. Chris Williams, WA3PSD, of Weber State College, assisted in the testing. The main thrust of the effort was to perform extensive software testing of the AX.25 protocol and the calibration of telemetry parameters. This software gathers the telemetry values and packetizes them so that they can be transmitted. The spacecraft will send telemetry either as unconnected packets or specific parameters, on request, to a connected station.

One of the most enjoyable aspects of the week's effort was the testing of the WEBERSAT CCD camera. WEBERSAT was set up on a table in the MicroSat laboratory with its camera pointed to the mountains around Boulder, Colorado. A command to take a picture was sent to WEBERSAT from across the room using VHF/UHF radios. The picture was taken, the information was stored and processed, and then it was sent from the WEBERSAT MicroSat back across the room to a laptop computer via a TAPR PSK demodulator, an MFJ TNC-2 clone, and ICOM 275/475 transceivers.

The Weber State College-developed software reprocessed the picture data and produced an excellent digitized image on an EGA screen. At this point, there was much joy and celebration expressed by the entire MicroSat test team. Chris Williams said that because of the launch delay, the software to process the pictures will be available from AMSAT-NA shortly before launch.

At this point there will be only minimal testing of the MicroSats until the launch campaign begins. Until then, only a skeleton crew will maintain satellites.

Source: AMSAT News Service / Gateway

by **Norman Sternberg, W2JUP**
279 Adirondack Drive • Farmingville, NY 11738

★ The 7-Character SELCAL ★

For those of you who are into AMTOR, I thought I'd pass along some information that may be new to you. I'm referring to the fact that the FCC's new Part 97 became law on September 1st, 1989 and has some new stuff in it about AMTOR.

The new Part 97 text does NOT specifically mention AMTOR by name. The applicable new rules are found in Section 97.309, Subpart D, and I quote the pertinent paragraphs verbatim:

S 97.309 RTTY and digital emission codes.

(a) Where authorized by SS 97.305(c) and 97.307(f) of this Part, an amateur station may transmit a RTTY or data emission using the following specified digital codes:

(2) The 7-unit code specified in International Radio Consultative Committee Recommendation CCIR 4761 (1978), 476-3 (1982), 476-4 (1986) or 625 (1986).

Here's what new:

1) CCIR Recommendation 476-4 was never cited previously. It is simply a 1986 update of the previous 476-3.

2) The citation of CCIR 625 is new. CCIR 625 provides an interesting upgrade to the SITOR/AMTOR protocol.

The number of identification signals (letters in the SELCAL) has been increased in CCIR 625 from the previously-available fourletter SELCAL derived from your callsign. Recommendation 625 now provides selective-calling using a SEVEN LETTER code called an "IDENTITY".

This new seven-character "IDENTITY" allows a slave station to automatically determine the identity of the calling station something not previously possible. With Recommendation 625, instead of having to wait for the calling station to send the usual "W2JUP DE W2HPM" stuff, when a distant station calls me by my new R.625 seven-letter "IDENTITY", I get a "message" from my multi-mode data controller that looks like this:

G^G^G *** CONNECTED to
MZKPMMM (W2HPM's "IDENTITY"!!)

which tells me that I'm linked via ARQ (625) to W2HPM. Kinda reminds me a bit of another popular communications mode.

What's also new is that the you (the user) cannot derive the new "IDENTITY" from your callsign as before. Recommendation 625 uses a unique translation table and routines based on modulo-20 division and thus can only handle 20 alphabetical characters (letters) and no numerals at all. The letters G, H, J, L, N, W, and numerals 0 through 9 are invalid. Thus, you cannot "make" a SELCAL from any callsign starting with "W" or "N" or "G" or any of the other invalid "identity" letters.

In one manufacturer's new AMTOR 625 firmware now at the dealers, you merely type "MYSELCAL<yourcall><enter> and the box "creates" your usual four character SELCAL (but you can still make it manually!). To "create" your seven-letter "IDENTITY", you merely type "MYIDENT <callsign><enter> and the box "makes" your new IDENTITY for you.

Here's a sample of what some IDENTITY strings look like for some typical callsign formats:

W2JUP	MZUUPPP
W2HPM	MZKPMMM
AI2Q	AIZQQQQ
G5ECI	CSECIII
KC2FD	KCZFDDD
KA2LCC	KAZFCCC
N2FRD	VZFRDDD
N2MH	VZMKKKK
AD7I	ADTIIII
KA1BCD	KAIBCDD
KB2CDE	KBZCDEE

3) CCIR 625 systems can intercommunicate with the existing CCIR 4762,3,4 tems as long as the CCIR 625 system calls the CCIR 476 system by using the four-character SELCAL instead of the seven-character IDENITY required by CCIR 625. CCIR 476 systems can call a CCIR 625 system if the 625 system has been programmed to allow calls to a four-character SELCAL.

4) Forward Error Correcting mode (FEC - Collective Mode B) is the same except that the CCIR 625 system sends more "end-of-transmission" symbols to ensure that the receiving equipment has shut down. This doesn't cause any incompatibility between 476 and 625 systems.

5) Selective Forward Error Correcting mode (SELFEC - Selective Mode B) differs between 625 and 476 in that the 625 system can transmit either a four-character SELCAL or a seven-character IDENTITY.

At this writing, there is only one (perhaps two?) CCIR R.625-compatible system available in the USA for immediate sale to the amateur radio community. Creation of correctly-implemented AMTOR 625 software is much more than just a quick hack to the existing software. It's a major coding task, definitely not "trivial". However, we expect that the picture will change quickly as manufacturers labor through the rewriting of the AMTOR/SITOR software. I expect we'll see more of this new AMTOR/SITOR equipment on the market very shortly.

de Norm, W2JUP

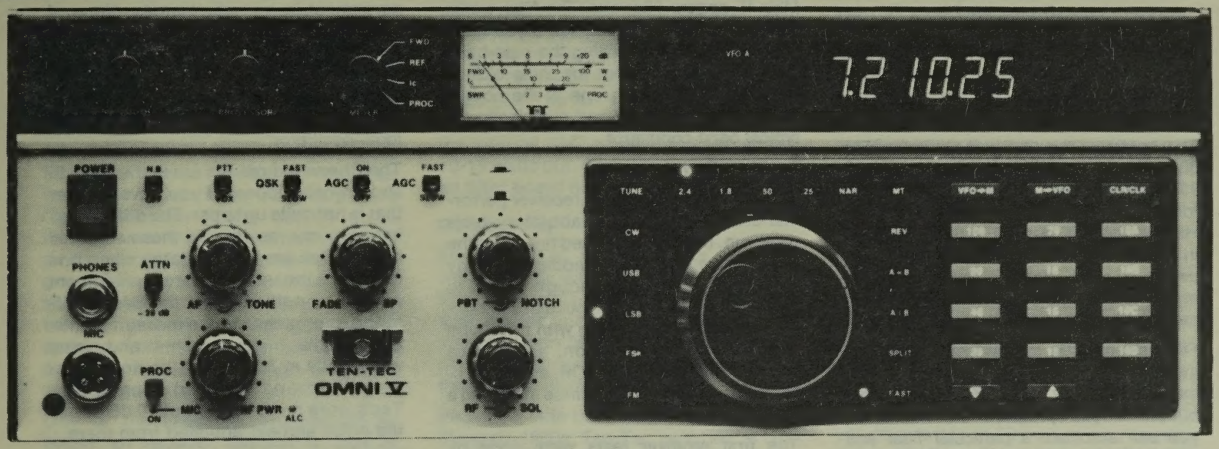
AMTOR! Try It - You'll Like It!

I have been trying to make some headway on HF packet for a long time. Even with the best modem or TNC available, the mode is just not easy to use. Sure, you can receive lots of overhead packets, but substantial QSO's are one in a million. AMTOR is just the opposite... NO overhead, lots of friendly QSO's and excellent data throughput in the worst band conditions.

A little guidance on equipment... The ever-popular PK-232, KAM or MFJ-1278 do just fine on AMTOR. The good thing about these machines is that the AMTOR code is built into the ROMs. (You can't just use a regular modem and a terminal program on AMTOR). The AEA CP-100 modem, for Commodore users has excellent filtering for AMTOR. Recently HAL has come out with an AMTOR card for MS-DOS machines (the PCI-3000).

Try out that "new" portion of your all-mode controller. You won't regret it!

de Craig Rader. N4PLK
CFPUG Newsletter



TEN-TEC OMNI V

Reviewed By: *Augie Hansen, KB0YH*
P.O. Box 37048
Denver, CO 80237-0048

Author's Biography

Augie Hansen is the owner of Omniware, a consulting and training firm in Denver, Colorado. The company markets a ham training program called, appropriately enough, Morse Code.

Augie earned a BSEE degree from the University of Rhode Island. He has written several books on programming, including the best selling "Learn C Now" (Microsoft Press, 1988) and he writes a monthly column for UnixWorld magazine.

The Ten-Tec booth at Dayton Hamvention (R) was busy again this year - perhaps more than usual. Most of the attention was directed toward the announced-but-not-then-released OMNI V, a 160 through 10 meter ham band transceiver. Well, the rig is available now and I'm pleased to have a chance to present this review of the new and improved Omni. In its outward appearance (see photo) and basic design, the Omni V is essentially a modified Paragon. In many ways, however, the Omni V is very different from it predecessor. In fact, the internal design owes as much to the Ten-Tec Corsair as it does to the Paragon, and it incorporates some innovative technology.

What's All the Noise About?

Ten-Tec's stated goals for the Omni V attempt to respond to complaints by amateurs who have seen the basic performance of commercial ham gear go down as the number of "features," some of questionable value, has steadily risen. The basic performance of many modern synthesized rigs is below what was available more than a couple of decades ago. For example, an alarming decline in real receiver dynamic range (not those inflated numbers in the transceiver ads) has occurred, resulting in a greater tendency toward the generation of intermodulation distortion products. This has happened at a time when signals are both more plentiful and stronger than they used to be. The diminished dynamic range of many modern receivers compromises their ability to capture weak signals in the presence of nearby, strong signals.

One of the culprits is the local oscillator (LO), which in modern receivers and transceivers is usually a synthesized, general coverage type. Such an LO design yields many benefits: general coverage receiving, multiple VFOs, frequency and operating-mode memory, and other desirable features. But this design also invites the problems noted above. For DXers, contest operators, and hams who live in close proximity to other hams, the benefits can be lost in a caucaphony of phantom signals and other masking noises, signal distortion, and a variety of other maladies.

Problems are not limited to the receiver, although those are the ones you're most likely to notice. Becasue the local oscillator is also used by the transmitter, any LO noise is amplified and radiated along with the intended signal. Even though it probably won't affect you, the noise might cause problems for nearby receivers.

Needs and Wants

Ten-Tec is betting that a significant segment of the ham population is willing to trade general coverage receiving capability for improved ham-band-only receiver performance. It's a bet I think they'll win if what I have been hearing lately is indicative of the ham population at large. Put simply, only a small percentage (about 5%) of the hams who have synthesized transceivers actually use their receivers outside the ham bands according to my informal survey conducted during on-air contacts and at ham club meetings). And among those who do, most say that they usually use it to check the time on WWV or CHU.

Interestingly, however, the inclusion of a general-coverage receiver affects a buyers choice of an HF rig. That seems a lot like buying a car with a built-in TV set that you probably won't ever use (unless you have a chauffeur). Is this "creeping featurism" a response to real needs or is it just a marketing response to our vague, ill-defined "wants?"

Ten-Tec's no-nonsense, ham-band-only strategy could work if there is an obvious performance difference that you can really hear. This review presents the results of detailed testing of the OMNI V. Emphasis is placed on the rig's basic performance and its operation in digital modes.

General

One immediately noticeable difference from the Paragon is the large, easily read digital display. Rather than trying to pack a lot of digits into a small space, Ten-Tec decided to help those of us who have old, tiring eyes by using a seven-digit, vacuum flourescent display for frequency. You can switch to a convenient time display (press the CLR/CLK button) or date dis-

(cont'd on page 8)

(cont'd from page 7)

play (press VCE once). Any frequency change or button press (except CLR/CLK or VCE) causes the frequency display to return.

The center of the CW audio passband is 600 Hz rather than Ten-Tec's traditional 750 Hz note. This new value was chosen for technical reasons (a multiple of 300 Hz due the PLL design), not to a change in design philosophy. The lower frequency is more pleasing to my ear and makes it easier to dig out a CW signal in crowded band conditions.

Filter selection is independent of operating mode. You can use any filter in any mode simply by pushing a front panel button. If you program the memories, you can associate a particular filter and mode with a frequency and store up to 25 such combinations for quick access. The Memory Tune feature lets you quickly scan through the memories by turning the tuning control knob and pressing the M->VFO button when you have selected the memory frequency you want.

The narrow filter position in the 9 MHz IF, activated by the NAR button if a filter is installed, is effectively placed in series with the 6.3 Mhz passband IF, providing up to 16 poles of narrow filtering.

The Omni V supports true FSK with the traditional 170 Hz shift (2125/2295 Hz). You can, of course, use AFSK to achieve similar results. If you operate RTTY or other digital modes that use signals close to these values, such as the 200 Hz shift of the PK-232 controller, you may want to install the Model 216 FSK filter in the 9 MHz IF narrow filter slot. The filter works well with shifts up to 225 Hz. If you don't have the FSK filter, setting the pass-band tuning control to about the three o'clock position and selecting one of the normal filters limits the passband sufficiently for typical band conditions.

Receiver Performance

To evaluate the Omni V's receiver performance, several sets of laboratory tests were run. In addition, I used the rig on the air in voice and digital modes regularly for about a month. Although I tend to work mostly DX and an occasional contest, I also enjoy chatting with folks who enjoy a real conversation, and I have become hooked on AMTOR, and to a lesser degree, packet radio since installing a PK-232 in the shack.

The first receiver tests were done by Robert Sherwood, KC0B, at the Sherwood Engineering laboratory using well-documented test procedures. The dynamic range and phase noise results were not as good as expected and we suspected a bad mixer or possibly a local oscillator problem. The unit under test was one of the first few units off the production line. I sent the rig back to Ten-Tec for a checkup and adjustment. Larry Boyd, Ten-Tec's chief engineer on the Omni V project, ran tests on the rig, replacing a marginal mixer in the process. Using the same procedures as Sherwood, I reran the tests in the Omniware lab. Table 1 summarizes the results of the tests and got numbers that were much closer to Ten-Tec's.

Although there are differences among the test results, there is obvious agreement in important areas. None of our test results matched the specifications in every category, but the Omni V compares favorably to the best of the standard LC-tuned receivers available, in spite of the fact that it uses a synthesized local oscillator.

The Sherwood results are in the table to show what happens if you have a mixer that is not quite up to par. The differences between my results and those reported by Ten-Tec are not too large when one considers the use of different equipment and lab conditions, and the use of differing approaches to the measurements. Sherwood's measurements and mine were made at 3dB above the noise (tangential to the noise power) whereas Ten-Tec's were made at a point 10 dB above the noise and extrapolated from there.

The dynamic range of a receiver is the difference between the noise floor (or minimum discernable signal--MDS) and the point at which third-order distortion products become measureable in response to two strong signals applied at a specified spacing. The table shows dynamic range two values.

One is based on the traditional 20 kHz spacing of the signals with the receiver's 2.4 kHz filter activated.

The other, a much harsher test, shows DR at a spacing of just 2 kHz with the .5 kHz filter activated. This may seem to be an unusually severe test, and it is not indicative of the average amateur's operating conditions, but it is typical of some DX and most contest situations. In Denver, I live in a part of town were big beams and kilowatts are plentiful. About a dozen fairly active hams are within a two-mile radius of my QTH and S9 ' 40 dB signals are common here on all HF bands.

Phase and amplitude noise is present in all oscillators, but synthesized oscillators that use phase-locked loops often exhibit very high phase noise values. The sideband energy produced by the noise can produce severe distortion when mixed with strong signals. You will want to hear one signal in the mixer output, but you won't want to hear any of the others. Distortion products make it hard to copy the desired signal.

The Omni V phase-noise level is excellent for a PLL design, comparable to the better LC-controlled oscillator types. This results from the use of a very high base frequency, 200 to 220 MHz, which is divided down by 40 to produce the 5.0 to 5.5 MHz output, which is then crystal-mixed to produce the signals needed to mix with incoming signals to produce the 9 Mhz IF signal. The oscillator provides an additional 30 kHz on either side of the tuning range.

(cont'd on next page)

TABLE 1

Test	Spec	Sherwood	Ten-Tec	Hansen
SSB Noise floor (dBm)	-133	-132	-132	-132
CW Noise floor (dBm)	-	-134	-134	-134
Sens. (uV for 10 dB SNR)	.15	.18	.18	.18
IMD Dynamic range (dB)				
SSB (2.4 kHz) @ 20 kHz	97	82	93	87
CW (.5 kHz) @ 2 kHz	-0	67	86	75
3rd order intercept	+12	-10	+7	-1
Blocking (100 kHz sep.)	-	+135	-	-
Phase noise (dBc/Hz)				
SSB @ 250 Hz	-127	-	-	-
SSB @ 2 kHz	-135	-	-	-134
SSB @ 5 kHz	-146	-137	-	-137
Ulimate filter	-	>100 dB	-	>100 dB

(cont'd from previous page)

Some of the Omni V receiver selectivity is obtained in the 9 MHz IF chain and the rest is obtained in the 6.3 MHz passband tuning IF subsystem. The IF and mixer circuits are well designed and shielded to provide excellent selectivity with ultimate filtering of greater than 100 dB. This is an important point. Many receivers have highly selective filters, but so much leakage around the filters that they fail to do the whole job. Also some filters have good rejection characteristics on the skirts just outside the passband, but they fail to reject signals correctly as the spacing from the design center is increased further allowing unwanted strong signals to pass through.

One of the problems experienced by nearly all receiver designs is that of birdies--signals generated in the receiver in the absence of inputs. The Omni V has very few birdies, none stronger than S3, and most don't deflect the S meter at all. However, a birdie can cause trouble if it is right on top of a weak signal that you want to copy.

The noise blanker, although of the same design as the one in the Paragon, is not as effective against very strong pulses. For example, it kills the "woodpecker" dead sometimes, but if the interference is too strong, it gets through the IF system. A noise blanker adversely affects receiver dynamic range, so be sure to turn it off before complaining about someone else having a "wide" or "noisy" signal. The problem might be on your end of the path.

Transmitter Performance

The transmitter performed well, meeting or exceeding all FCC minimum requirements for spectral purity. The carrier suppression is greater than 60 dB and the unwanted sideband generated by a 1.5 kHz audio signal is suppressed more than 60 dB. Using a two-tone input audio input and full output (88 watts on 20 meters), transmitted third-order IMD products were 32 dB below the PEP power level and fifthorder products were down about 50 dB.

This table shows the power output for each band as measured with a Bird 4431 Thruline (tm) wattmeter into a Drake 50 ohm, 1 KW dummy load.

Band	Output
160m	85 watts
80m	92 watts
40m	90 watts
30m	88 watts
20m	88 watts
17m	90 watts
15m	82 watts
12m	88 watts
10	93 watts

These power output levels are sufficient to drive an SB220 linear to nearly full output and are more than adequate to push a Ten-Tec Titan linear to a full 1500 watts out. The RF PWR control lets you adjust the power from full output, set by the internal ALC control, down to about 10-15 watts out. A pot on the 9 MHz crystal filter board sets the ALC limit.

Construction

Early Ten-Tec rigs used lots of small circuit boards with push-pin type connections to chassis-mounted headers. They were reliable, but many of the boards had the same form factor and connector positions, sometimes causing confusion for those assemblying or repair the rigs.

Beginning with the Corsair, introduced in the early 1980s, Ten-Tec switched to larger circuit boards with masstermination connectors, reducing assembly costs, and helping to keep the rigs in a competitive price range. Circuits are arranged in logical groupings and built on screened, G10 epoxy printed circuit boards. Figure 2 is an interior view of the Omni V showing some of the boards and cabling.

Circuit components are clearly identified and lay flat against the board, so they are easily readable and accessible if you want to modify your rig or ever need to repair it. The cord-wood layouts used by most manufacturers produce more compact rigs, but such rigs are really hard to test and repair.

Room For Improvement

There is room for improvement in any rig. The Omni V is no exception. It is a solid transceiver with an appropriate feature set. However, if I could have my way, I'd make a few changes in the design of the Omni V. I suggest these items as possible future revisions and enhancements.

IF Window Problem. First, the Omni V needs a way to beat the "window" problem at the first mixer. The Omni V uses wide bandpass front-end filtering ahead of the first mixer and a 15 kHz wide, four-pole crystal filter after the mixer. The bandpass filters provide good rejection of image and other out-of-band signals. But there is nothing to prevent strong signals within the 15 kHz window (where your desired signal is located) from reaching the second mixer. The result is significantly diminished dynamic range and an increase in IMD product generation that make copying the desired signal difficult or impossible.

A sharp, switchable input preselector or a narrow crystal filter at the output of the first mixer would help a lot in contests and other critical situations. Extreme input selectivity isn't needed all the time, but when you need it, you really need it!

The Omni V is certainly not the only rig to suffer the IF window problem. Indeed, only a few rigs offer sufficient front-end selectivity to prevent this problem. Put two or more transceivers inside a tight circle for a multi-station contest operation and hear what happens to the average receiver that lacks the needed front-end selectivity. Not a pleasant sound. Elaborate preselectors and frontend filters in addition to careful band and mode planning are often necessary to minimize interference.

USB/LSB Selection. When you change bands on the Omni V by pressing one of the band pushbuttons, the mode and relative frequency offset from the bottom of the band don't. So if you're running LSB on 40 meters, say at 7.158 MHz, and you fast-switch to 20 meters, you end up at 14.158 MHz still in LSB mode. I would prefer that the rig switch to the recognized default sideband, like the Kenwood TS440S and similar rigs do.

A way around this problem is to use the memory tune (MT) feature and program the frequencies and modes of the band segments that you most often use. Then you only need to press the MT key, tune to the frequency you want (a very quick operation), and then press M->VFO key. I like the fact that the receiver stays tuned to the frequency you're listening to until you instruct it to copy the memory data to the VFO. If you change you're mind, just press the MT key a second time to cancel the command.

Lasting Impressions

The Omni V has a flexible, quiet receiver, a clean transmitter, and provides fast, precise QSK operation. It is easy to operate, controls are thoughtfully arranged and adequately spaced for even fat fingers.

Ten-Tec, always the leader with regard to QSK operation, does nothing to tarnish that well earned reputation. Indeed, a large percentage of Ten-Tec owners are CW operators who bought their rigs primarily because of the full QSK feature. That same feature contributes to the Omni Vs performance AMTOR mode, which requires fast transmit/receive switching.

I can recommended the Omni V to virtually any ham. DXers and contesters will appreciate its excellent receiver, fast band-changing controls, dual VFOs and memories, and excellent filtering. The digital operator will appreciate the 10 Hz tuning resolution and frequency settability needed for packet, the availability of a narrow FSK crystal filter, fast T/R switching, and more.

(cont'd on page 17)

BITS & BYTES

by Lacy McCall, AC4X

3001 Zelda Drive • Montgomery, AL 36106

WHATS YOUR INTEREST ???

Someone asked me one time, "What are you interested in after sex?" At the time I said "a cigarette" and quickly recanted. It had taken a moment for me to comprehend. What I am interested in covers a lot of topics, and what you see in this column, usually if represents my current focus. Lately, it has been operating in general, and programming in particular. Regarding the former, I still have not been on the band nearly enough and once again promise to rectify that. Regarding the latter, I've been overworking that a bit. Order and balance are both achievable, given a little desire. In your quest for the best, try moderation and balance.

What I have put aside for the time being is the purely technical aspect of digital communications. This includes the specifics of the various protocols, satellite operations and the development of newer and better equipment for digital communication. Others in this journal have been covering these topics completely. You should take time to explore what they are touching on. This month, pick one topic you find in this issue that you don't know much about. Read the article, and then look for other sources on the topic. One new interest every other month or two, might liven you up a bit. I plan to try this myself.

SAME SONG ...

If you ever encounter, or like to watch any one of the many TV evangelists, you know that it is easy to "fall from grace". You also know it is just as easy to "repent". Once again, I have repented and am fooling around with the HOST mode. Lately, because of two independent software projects, I've been working with both the WA8DED and AEA's versions.

Finally, I've found the way I think "host mode" is useful; to receive. After writing two sets of routines in C, I am reminded why I don't like talking directly to the TNC. I find it a waste of time to re-code all the command phrasing necessary to tell the TNC something and phrase a response. The TNC already has perfectly good coding to do the same thing. What I failed to understand is how good the host mode is at telling you the mode of operation, status and the like.

The suggestion I have for the whiz kids that are responsible for such things, is to give me a Host Mode that works only one way. I want to be able to send a host command to the TNC using host coding, poll the tnc and get a host response and de-code that. If the command is not host coded, I want the TNC to respond as if it is in the command mode. To me that is the best of both. While wishing, I want to be able to send a host command, properly coded, without switching to Host Mode. Do you suppose there is any chance of the dream coming true?

LETTER TO THE EDITOR ...

This is to let you know how much I enjoyed Jim Mulvey's column "Action On The Ham Bands" in the last issue. It was refreshing to hear that even extras make mistakes. I read Jim's "True Confession" just after writing "Going 5 in a Kilowatt Zone".

GOING 5 in a KILOWATT ZONE ...

"I did it. I'm not glad and I'm not proud. Officer, I promise that I won't do it again. It was just a mistake and I'm only human."

This was my response to getting pulled over. The little notice came in the mail from an "official observer" that I had operated out of band; not much, but just enough. For the technical readers, it must have been one half my signal that was out of band. It is apparent that I am the only one guilty of such a violation so I feel compelled to explain. If talk about it, maybe I can clear my conscience!

About four years ago, I set up a station at my house on the Gulf coast near Destin, Florida. One of the rigs taken there was my 12 year old Ten-Tec Argonaut. Also, I have an Icom 735 there, but few good antennas. Recently, however, I installed a Cushcraft R-4 which does a very good job for a vertical. Before that, the little Argonaut sat idle. Not much use using QRP without a good antenna. Besides, it is mostly an emergency rig.

Since I am now into this digital thing, the Icom gets a lot of work all across the band. As it happens, hurricane HUGO was bearing down on the Caribbean. I wanted to monitor the Hurricane Watch Net on 14.325 mhz, and copy the Navtex transmissions at 520 khz. Thus the Argonaut was pressed into service on 20 meters.

First, I had a hard time figuring how I had it hooked to the antenna system. You see, I only have one good antenna, but I do have several. Once I figured out the connection and I could hear something, I tried to tune the dial and the damn thing was stuck.

Now the Argonaut is not a "mickey mouse" rig, just low power. The dial mechanism however is not very good.

In about a half hour, I had the dial cord and elastic working nicely and proceeded to calibrate, using the 14.325 net as a reference. It was a successful repair and I was very proud. Then the QRP bug snuck out of the rig and bit me hard.

Not knowing how many of you are QRP freaks, you may not know what I mean. There is a real thrill working a kilowatt station using only 5 watts. Contacts are easy on CW using a reasonable antenna and good band conditions. SSB is another matter. Due the many stations when conditions are good, you have to pump up the 5 watts to make a contact. Long ago, I learned that calling CQ and getting a SSB response using QRP takes a lot of patience. I know very well the Argonaut dial is not well calibrated, either from band to band or within any given band. It is much simpler to listen and respond. That is easy, safe and more likely to produce success.

The itch needed scratching, so I tuned the band looking for a CQ. I was not even sure the rig would transmit, and cannot remember the last time the transmitter was keyed. It must have been at least three years ago. Then I heard what I was listening for. A station was calling CQ at the top of the band. He will remain unnamed, since he can do his own confession. His signal was a good 5 by 5 and if he was using only 100 watts there was a good chance my 5 watts would be heard. I called twice the first time and received no answer. After that I called him several other times using the QRP practice of persistence. The guy never heard me, so I tuned some more. It did occur to me after he didn't respond that he may have been too high in frequency and realized it. You see, I couldn't tell from the Argonaut. I just relied on the caller and that was a mistake. I did tune around some more that day and tried to bust some pile up down around 14.200, but you can guess how well that worked. Sure, I was disappointed that I had not made a contact, but the rig seemed to be working nicely, and at least I had tried.

My disappointment was wiped clean when my mail came a few days later. The QSL from R. L. Nitsch, W4NTO was entitled Official Observer Advisory Notice. His report was 4 by 6 in Spartanburg, SC. The frequency noted was 14.349.8 USB. I knew that Argonaut was a good rig.

MORE COPS AND ROBBERS ...

As anyone who operates any at all knows, illegal operation by American amateurs is frequent. It is not usually willful or intended. Most hams have transmitted with a switch in the wrong position at one time or another and sometimes there has been someone around to remind us. Often this "band-cop" is a guy who himself operates illegally in letting you know. This is often true on split frequency operation that straddles the band edge.

The bother to most of us is the operator who willfully causes interference to others. Why they do it is unclear to me,

(cont'd on next page)

(cont'd from previous page)

and I would like to see them stopped. The strange thing is that I was warned, albeit politely and correctly, for running 5 watts one sideband above the permitted frequency, yet I hear people causing willful interference constantly. All have heard a station "broadcasting" and pretending to be in contact with another station, even when we know it is not so. The station is easy to identify. Why does it persist?

To answer my own question, I guess that amateur radio is like the rest of society. Cops find it a lot easier to stop petty crime while the bad guys get away. Official observers are a good idea and do a lot of good reminding us good guys when we stray. I am sure they also try very hard to get the bad guys also. Let's hope they have some luck.

As far as self-policing goes, I have my doubts. Self proclaimed cops just irritate others and don't contribute anything. Nobody likes to be admonished by a peer, particularly if the peer is wrong. Where self policing does work is in the quality of the amateur operators. The more people on the band that care about what they do, the better. The hobby has survived all these years not because we have been made to do right, but because we want to do right.

If you are new to amateur radio, don't be bashful about pressing the key. Sure, you may make a mistake occasionally. Everyone does; but remember, be courteous and take time to know what you are doing. Even when others may not do the same. The more you respect your privileges, the better it is for us all.

UDATE ON A BARGAIN .... AND MORE ....

In a previous issue, I mentioned the "C/Database Toolchest" by Shrier and Deihl, which is licensed to and distributed by MIX Software, Inc. of Richardson, Texas. Recently, in search of some code for a specialized application, I spent a little time with the library. The results were very pleasing.

To help understand my comments, I would like to explain one of the programming complications that exist using the available libraries. First, since most of the C Compilers don't have full window functions. You must either code your own or use a library of routines prepared by either a hobbyist or commercial vendor. The same is true for keyboard routines.

The result of all this is that when combining the best from more than one library, you get conflicts in the way a particular programmer defines his routines. An example would be in the keyboard routines, where one vendor might return from a function giving the key code and scan code for a key entered. Another might use a specialized table of values.

Once you use both libraries, the program will likely work properly, assuming the code was well done initially. However, what you will have done is to include two or more definitions of the same thing. One definition for each library and the functions used from that library. The result is a larger than necessary program.

Another example of library usage could be the use of menus, windows and forms. In my case, I like the routines from one vendor for windows. The routines are clean and fast, but I don't like the menu routines from that library. They work well, but are limited and difficult to customize. Since menu routines have to use windows for display, once again, two sets of window routines are used.

All the above is fine and is probably the fastest way to a final and properly working program, but it is inefficient. It would be satisfying if life and programming were more orderly.

The second hitch in using libraries is the compiler. Most programmers offering library routines to other programmers have be able to produce code for more than one compiler. Whether it is Microsoft, Borland or one of the several other good and widely used compilers, makes a big difference. This is true particularly in the way definitions are made. Often, to recompile source code from a library, either you have to suffer with many warnings or take the time to wade through the code and check the errors and warnings. The warnings may not be errors at all, but the way the particular compiler sees the code. Some change in definition, or additional code may very well satisfy the compiler. Where we are lucky to have a multitude of compilers, we must suffer the lack of uniformity. Reviewing Shrier and Deihl's code, I found a particularly useful set of routines. Without doing much checking, I told Turbo C to compile the code to an object file. The first pass, revealed that I needed to tell the compiler where to find the files to be included. Once this was done, bingo, success. It was a plesant surprise. Inexpensive and good, is a hard combination to beat.

Since we all tend to criticize quickly, we should also take time to say thanks for something we find that is good. Shrier and Deihl who wrote the code did a good job and it should be stated.

PROGRAMMING STYLE ....

Since we are on the subject of program code written by others, it is worth noting that each programmer has a unique style. You do and I do. Whether you use Basic, C, Prolog, or some other language, your style will soon be evident when you take time to look back at what you have written.

Much computer code in most programming languages is available. In reviewing the work of others, you can quickly determine if the style you see is one you wish to emulate. How good are the comments? How clear are the variable names? How confusing is the nesting? How much external reference is used? All these things affect code readability and clarity.

If it works, that is great. If you wish to modify even your own code after a little time passes, good style is important. Take time to review your work and what others have done. Improve your style at the keyboard, and you will be rewarded later.

SOWHATSITGONNABE ...

For an explanation of Digital Transmission, see the articles in this journal. Here's a short review of the options in mode usage:

PACKET (VHF): You can chat with locals or check the local BBS for messages or bulletins that may be of interest.

PACKET (HF): You can hear a lot of signals, mostly traffic being passed. You can make contacts, including DX. Try 10 meters for a QSO.

AMTOR: Good mode to chat and make contacts. A few BBS and/or mailboxes are available. Reliable data transfer since the rate of transmission only slows as the link deteriorates.

RTTY: Good for contacts and BBS access. This mode offers little error checking and if conditions are not good, you may get a lot of junk. Been around longest and has more old hands.

FAX: If you like to SEE the results, try FAX. One FAX=1000words? You will be seeing a lot more of this mode in the future. Don't let it pass you by.

My preference is all the above. One personal observation, is that I think more stations are trying Amtor. That is where the most activity seems to be. I suggest, that when band conditions are good, you try RTTY. It is faster copy and more akin to CW, in that you have no actual link with the other station, you are just in contact. So what if you do get a few hits, who cares?

If you are interested in checking into the various BBS systems, all the modes (except FAX) have Bulletin Boards available. Because of the traffic

(cont'd on page 13)

by Mike Bryce, WB8VGE
2225 Mayflower NW, Massillon, OH 44646

Joining The QRP Fun!

Operating low power can be a whale of a lot of fun, especially when hitched to a multi-mode computer interface. What kind of results can one expect when running less than five watts output? Depending on the mode selected, the results can be just short of outstanding!

Low power operation, or the so called QRP operating style has primarily been a CW operators utopia. And while most people dismiss the idea, CW really is a digital mode. Operation at the two watt level can provide world wide communications.

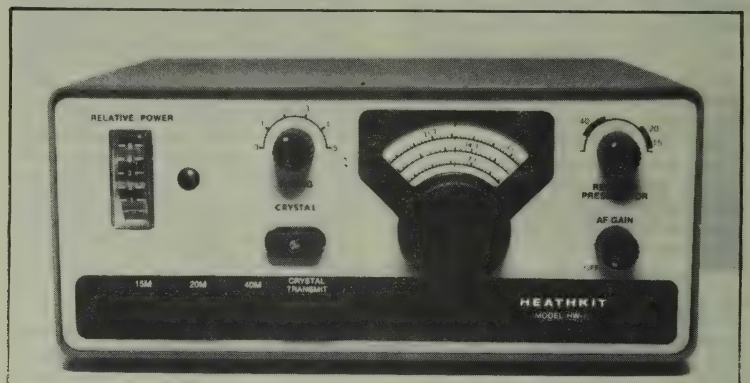
So, what is needed to operate, successfully, the newer digital modes, at power levels of two to five watts? Well, lets first look at what type of radios are out there. Modify, build or buy?

QRP operation is really not much different from running a standard transceiver. Running 5 watts output will only be 3 S-units lower than the guy running a full 100 watts output. Nothing else is needed. Low power operation also allows for portable use. Low energy requirements means battery operation in the field is quite common. Running packet with a watt or two, portable may be the only link of communications during a disaster.

Most of the QRP radios fall into one of three categories. Homebrew, kits, and commercial made units. As the name implies, homebrew radios are just that. Built in the corner of the shack, these units represent the best value per dollar. However, a lot of us just don't have the gray matter to design and de-bug a PLL multi-frequency transceiver. Almost all the homebrew designs are centered around CW operation with crystal control of the transmitter. The receiver may also be crystal controlled. The use of a direct conversion receiver in a homebrew transceiver is very likely. Sometimes only the transmitter will be built. In this case, a separate receiver will be used. A commercially built receiver is ideal. When using a separate receiver, the switching between the two, receiver and transmitter, can cause some trouble when interfacing with the digital modes.

Next on the list, transceivers built from kits. The most notable of these, without question, the Heathkit HW-7, HW-8, and HW-9. Each of these, an improvement, from one to another, represent a solid line of low power transceivers. The Heath QRP transceivers are quite small and light weight. The HW-7 and the HW-8 use direct conversion receivers. The HW-9 has a super-het receiver.

The HW-7 should not be considered for use with digital communications. The receiver is very lacking. The HW-7 can be a real challenge just to communicate with someone using CW.



The "grand daddy" of commercially made QRP rigs - the Heathkit HW-7

Commercial built low powered transceivers are also available. Ten-Tec comes to mind as having the best in the world in commercial QRP transceivers. The Ten-Tec Argonaut is world class.

Now that we've seen what is out there for the low power enthusiast, what do we need to interface these radios to the digital world?

Well of course you'll need a computer or terminal. A multi-mode computer interface would be a good choice instead of a dedicated unit. Software to interface everything together would be nice also.

Digital communications can be a bit different from the what most of us have been use to. Selectivity, sensitivity, while important, must give away to such features as PLL lock up time and, perhaps even more important, stability. Operation using AMTOR will require lightning fast QSK, something even the best commercial transceivers have a hard time doing. HF packet requires a very stable VFO. What modes, besides high speed CW can we use?

High speed CW is very easy to operate at QRP levels. The only problem would be stability in frequency control. Most high speed ops don't use QSK (full break-in) but some do. A HW-8 can handle most speeds up to around 50 WPM. Faster than that, the bandwidth of the HW-8 receiver becomes too narrow. Dial calibration in all the HW series is less than spectacular. Using a CW bulletin board would be a real headache.

The Argonaut and the Argosy both can handle high speed CW with ease. Both will operate full QSK without trouble. The Argonaut series does not have the required dial calibration for CW BBS. It will get you close, but not right on.

Other digital modes are not quite as easy to interface to the QRP rigs as CW. Baudot operation is possible. In fact, I've worked a fair amount of DX with the Argonaut with two watts output with an old model 19 TTY machine and a homebrew ST-5 demodulator. Since the Argonaut can transmit using SSB, it is a simple matter to just plug in the AFSK tones to the microphone jack. The Argonaut can hold its frequency to within the 170 Hz required by the demodulator. The HW series don't have SSB ability. However it is possible, with a bit of work, to use the HW-8 or HW-9 for Baudot. I've never done this, but it should work. All you have to do is shift the VFO 170 Hz. A small capacitor switched in and out of the LC circuits will cause the VFO to move. A diode switching the capacitor in and out of circuit can be controlled via the terminal unit. Now there is a problem with this when using the HW-8. The HW8's VFO multiplies its output as you change frequency. A shift of 170 Hz at 20 meters will NOT be the same on 15 meters. You'll have to settle for one band to operate Baudot on. Again, I've never tried this, but in theory it should work. After a good warm up and a stable supply voltage the HW-8 will (should) be able to hold frequency for Baudot operation.

AMTOR and Packet require a different thinking altogether. Sorry, but you'll have to forget about the HW-8 and HW-9 for AMTOR and Packet. While neither have a PLL to worry about, you just can't interface either one for AMTOR or Packet use.

(cont'd on next page)

(cont'd from previous page)

The Argonaut will handle AMTOR and PACKET. The dial calibration is a bit rough for dialing up a packet BBS, but you should be able to operate using this mode. The Argonaut does not have a PLL. No lock up time is required.

So, do I have to be happy with a old radio to operate QRP? Well of course not. The Icom 735 has been a very good radio for QRP use. All you have to do is turn down the drive. For the purist, an internal control can adjust the 735 down to milliwatts, with full ALC control of the power output. The 735 of course has a PLL, but the turn around time is fast enough for AMTOR. The LCD display allows for precise tuning. Easy to find the BBSs on the band. The Icom 726 can be adjusted down to QRP levels with just the twist of a front panel knob. As a matter of fact, most, if not all radios can run at low power, just by reducing the drive/RF controls. Both Kenwood and Yaesu have made QRP transceivers. The Kenwood TS130V is a low powered version of the 130. Yaesu made the FT-7 and FT-7B, also low powered. Newer transceivers from both Kenwood and Yaesu can very easily go QRP.

Listen, listen, and listen some more as the old saying goes, "You can't work'em if you can't hear'em." Change frequency often. Twenty meters will prove the best band to work AMTOR and Packet. Baudot is also very popular on 20 meters. 40 meters and eighty meters can provide very good conditions for QRP Baudot and high speed CW.

Tail end a QSO by calling the loudest stations after a QSO. He will more than likely still be on frequency, filling out his log book and hear you call him back. Try sending his call two or more times. If nothing happens, try the other station. Perhaps the other guy will hear you.

Don't waste to much time calling CQ. But, don't forget to give it a try now and then. Sometimes you'll get a QSO started with a CQ. Throwing in a CQ QRP helps also.

Be sure all the equipment is in good working order. Modems should be on frequency. Remove all those extra in-line gadgets from your feed line. You don't want to waste RF with three dozen in-line watt meters do you? All your antennas should be in good working order also. In resonance for the frequency you are operating at. Try not to use a antenna tuner.

TEN-TEC ARGOSY: A versatile all-mode, switchable QRP/50 watt transceiver

Since running at QRP levels is not push button communications, it takes a bit of getting use to. While you'll only be between 1 and 3 S-units lower when running 100 watts, most people will answer the stronger signal. Operating QRP is more in the mind than in the radio. If you defeat yourself by thinking I'll never be heard, you've lost most of the battle already. Operation at the five watt level requires thinking a bit off center, from the rest of the crowd. While it is beyond the scope of this article, I'll point out some of the better methods of low power operation.

Propagation is a very important tool. If the kilowatts are having a hard time talking to each other, better leave QRP alone and watch TV. You'll never make it. You'll lose a small amount of power if you do.

Above all, don't loose patience. QRP operation is not push button QSO. Don't give up. After you have made a contact or two, the rest just keep getting easier. As I mentioned earlier on, this article is not a wire by wire guide on QRP, but rather mean't to give some good basic hands on guidance. You don't have to run a lot of power to enjoy ham radio, and the newest in digital communications.

EDITOR'S NOTE:

If you have news and information of interest to the digital amateur radio community... please let us know!

(cont'd from page 11)

system, most now contain a lot of the same bulletins, but you might find a jewel now and then. On Vhf, what was good sport is now bad taste. It is no longer acceptable to digipeat across several links and check into some remote BBS. In the first place, the frequency where you are likely to find the digipeaters, is used heavily for BBS traffic handling. The BBS stations using that frequency will likely tell you that the frequency is for BBS ONLY connects. Second, the use of Net-Rom, level 2, or what ever you call it is supposed to make digipeating obsolete.

The result is a Vhf system where an individual operator uses level 2, and should only call remote individual stations. I don't see much of that here. Since the BB Systems are so busy sharing information, you local BBS, on a secondary frequency, is probably the best bet.

TEASER OF THE MONTH ...

Get a pencil and a piece of clean paper. Assume that you are no longer around. If you don't like to think about passing on, assume that you have run away to start a new life with a 25 year old sweet thing. Draw a vertical line down the middle of the paper. On the right side list all the things that you have that you are sure that no other person in the world wants. On the left side list all those things that you don't want anyone else in the world to have. Throw every item on both lists away.

de Lacy / AC4X

500,000 Radio Amateur Call Signs at Your Fingertips

Introducing Buckmaster's HamCall on CD-ROM

Over 500,000 call signs in the U.S. and possessions are available, searchable by call sign, name, address, city, state, Zip code or license class. Using CD-ROM optical disc technology and your micro-computer, you have instantaneous access to the Buckmaster HamCall data base.

Complete Ham Listings

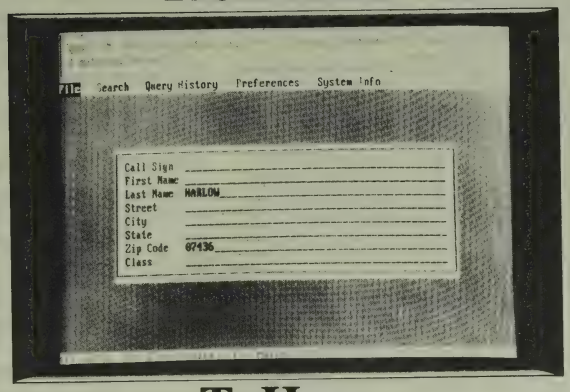
HamCall on CD-ROM provides complete listings by simply entering last name, street, city or Zip code. Find all the Hams in the U.S. with the same last name. List all the Hams in your area by Zip codes or cities. Print mailing labels for all Hams in your club's area for recruiting purposes.

$499.95 per Package plus Shipping (Quantities Limited)

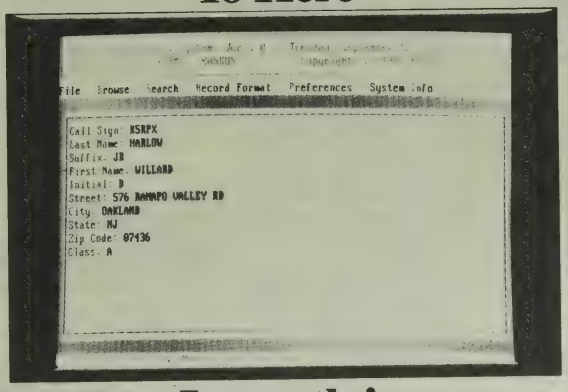
HamCall on CD-ROM is a package that includes the CD-ROM data disc, a Sony CDU-6100 external CD-ROM drive with interface card for IBM PC/AT type computers,* and MS-DOS CD-ROM extensions software.

Publishers Data Service Corporation's new Questar™ retrieval software package is also supplied. This retrieval system enables the user to search the CD-ROM data quickly and efficiently.

From Here



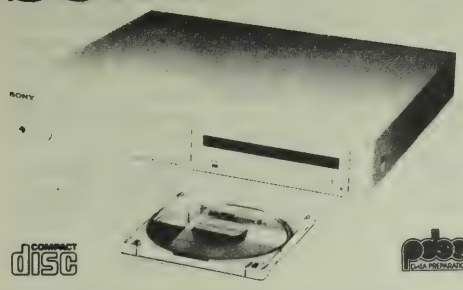
To Here



Instantly!

Order by calling 1-800: 282-5628

SONY



BUCKMASTER

"Whitehall" Route 3, Box 56
Mineral, Virginia 23117
703: 894-5777

VISA MasterCard

*Requires 640k RAM, hard disk drive and MS-DOS 3.1 or later version.

by Jim Mulvey, KS1A
60 Serenity Dr., Tewksbury, MA 01876

RTTY: Operating Tips

Sure, you may be an old hand at RTTY! But just maybe you could pick up a tip or two here. Or do you know someone who isn't as well versed in BAUDOT as you are? Then why not pass on this copy of Digital Digest to that person!

Tom was in my shack at the KS1A radio ranch munching on a chocolate-chip granola bar and slurping coffee with me. TOM IS ONE OF THOSE PEOPLE WHO KNOWS EVERYTHING. Just ask him. On the repeater his voice is deep and he has a distinct knowit-all understanding of everything to do with ham radio, airplanes, and life in general. Just ask him. Really.

"Hey!" I happily exclaimed leafing thru the cards that just arrived from the one-land QSL buro, "I finally confirmed CE1EGV for country number 208. I can't believe it took me this long to get Chile".

"QSL's are lame", Tom stated authoritatively. "I'm losing interest fast in the whole ham radio thing." He was dripping crumbs into my keyboard.

"No, QSL's are great! Take a look at this full color photo card from the P40V gang that just came in from Aruba! There are so many fun parts of Amateur Radio, like Dxpeditions to exotic places. Besides, you didn't think QSL's were so lame when you needed Hawaii on 80 to finish your 5 band Worked-All-States."

Tom thought, and then continued to pontificate, "QSLs are alright. But it seems like all the contacts you make on the air now-a-days are just signal report and QTH and then 73! I'd actually like to spend more time rag chewing. And that's getting harder to do."

"What you want are the digital modes my son! RTTY and AMTOR are just the ticket to get rid of those short contact blues that ail you. It's a blast and the average contact lasts half an hour to 45 minutes. And, you really get to know the person you're working."

"I'm listening," he said looking down at console. I'm quite proud of the layout of my shack. Borrowing the idea a few years ago from my friend Peter WB1GEX, I fashioned out of plywood a very neat set of compartments and shelves for my gear. Each of my radios and accessories fits snugly within their designed space, with three quarters of a inch or so of space surrounding for ventilation. And sitting smack in the middle, right next to the main rig is the monitor scope. A very handy item for those of us who know the pleasures of the digital modes of amateur radio.

The scope was displaying the tell-tale "cross-loop" pattern of the RTTY station I had the rig tuned into from Halifax on 6.3325, well below 40 meters. It seemed to me that Tom was more interested in the pattern on the scope than on the weather information being printed out from CFH in Halifax.

I spun the VFO and moved the rig up on 20 meters.

GETTING STARTED ON T HE AIR

"Here's a good place to begin the RTTY lesson," I said, letting the VFO stop at about 14.086. "On Twenty, this part of the band is the land of RTTY, from about 14.080 to 14.095. Go below .080 you're venturing into AMTOR territory and above .095 are the DX beacons and the HF packet stations. So we'll set up camp on a clear frequency here."

"How do you ask if the frequency is clear on RTTY?" he grunted. "Send QRL in MORSE code?"

"Excellent question! I wish more hams would think that way in the RTTY portion of the band. You see Tom? You're still wet behind your Baudot ears and already you're asking good questions."

He rolled his eyes.

"The ARRL's fine Operating Manual suggests you listen first, and then type a couple of "QRL?"s on the keyboard. I do this twice and then listen. It's the same rule no matter what mode you're on. The frequency may be in use by a nearby station that you can't hear. There's nothing worse than those guys who open up on your frequency with a few hundred RY's. So send a few QRL's and then listen. There may be a station using the channel a few kc above or below you who because they're not right on your frequency, won't be able to immediately print your QRL's...but he'll let you he's there if you listen carefully.

"What's a 'string of RY's'?" he asked in a friendly tone that was uncharacteristic. I felt sure he wanted something, probably was going to ask for another chocolate chip granola bar. Or maybe he was getting interested.

"Sending a string of RYRYRYRYRYRY's goes back to the old days of RTTY when you needed to turn a knob called a "range-finder" to correctly tune what the other station was sending. Nowadays, used sparingly it still makes a very handy signal to help people tune you in when heavy QRN is on the band."

I found what seemed to be a clear frequency, and after listening for 15 seconds or so typed "QRL? QRL?". When no response came I typed "QRL? QRL? QRL? DE KS1A". We we're all set to go.

"Hold on just a minute. You have the microphone plugged into the mic jack of your rig! Shouldn't your TNC (the RTTY box) be plugged into the rig? How are you able to send?"

WIRING THE RTTY BOX TO YOUR RIG.

Steve is a novice friend of mine who like most people normally had his mike plugged into the front of his rig. When it came time to change over to RTTY he hated unpluging the mic and plugging the wire from the RTTY box back into the mic jack. A setup like this is very common... and aggravating! THE KEY TO AN EFFICEIENT AND GOOD LOOKING SETUP LIES AT THE REAR OF MOST RIGS. Most of the later model transceivers have jacks at the rear marked "accessory" or "FSK", or both. If your rig doesn't have one of these, all is not lost. You'll just have to go through the mic jack.But if you do have one of these sockets at the rear you're really in business!

Leave your mic plugged into the front of the rig, AND PLUG YOUR TNC INTO THE FSK JACK AT THE REAR OF THE RIG. If your rig has a rear accessory socket you can really go to town. Because usually this socket has pins for speaker audio out of the rig (to your terminal unit) and pins for audio into the rig (from your terminal unit! for AMTOR, AFSK and PACKET). This means you NEVER have to disconnect the mic when you wish to go on rtty. The connections are made directly to the back of the transceiver! (However keying Kenwood rigs from the rear socket will also turn the mic on at the same time. And that means along with your HF PACKET signal whatever is being said in the room will be sent, too! The solution is to jumper one of the pins on the socket so the mic is muted while the rig is keyed by your TNC. Or, simply turn the mic off.) BEST OF ALL THERE ARE NO EXTRA WIRES SHOWING IN FRONT TO CLUTTER UP THE FRONT OF YOUR SHACK!

If you're new to reading these jacks and sockets, don't be turned off! IT IS VERY VERY EASY! Your rig's manual will tell you exactly what pins do what. And it's good to learn these simple concepts right now. You'll be wiring a lot of socket pins in your digital-ham career.

Tom complained, "Yeah, yeah. My old TS-820 doesn't have that kind of accessory jack on the back."

"If you don't have a rig with an accessory jack to do what I've described, there is another way to beat the mic connector

(cont'd on next page)

(cont'd from previous page)

blues. Simply pick up a small metal box (metal so it's shields from RF) and simply install two mic sockets to it. Plug your mic into one connector and your cable from the terminal unit to the other. Then from out of your little metal box run a shielded cable to your rig's mic input. You'll be all set, and never have to change cables again when you want to go from mic to RTTY, AMTOR OR PACKET!"

I sat down at the keyboard and with the push of one button the rig was placed in transmit. Out came, "CQ CQ CQ CQ CQ CQ CQ DE KS1A KS1A CQ CQ CQ CQ CQ DE KS1A KS1A PSE KKK."

"Pretty neat." said Tom. "You have that stored in your computer's memory."

"Yep. I have all sorts of strings like that stored in the computer. One is a whole paragraph that tells about my equipment and my town. And when I use the ARIES-1 software I can actually include "variables" in the text. That way the name of the person I'm working automatically gets inserted in the pre-programmed script. Say I'm working you...on RTTY. I type your name "Tom", into the computer. My computer inserts your name into a little file I have and prints, "Nice to work you (TOM) here on rtty. Your rst (TOM) is 579 from Tewksbury, MA..." The computer can insert all the info you've given me about yourself into the text I send you. I can thank you for the RST of (599) you gave me from (NEW HAMPSHIRE), and so on.

Just as my TNC finished sending the RTTY CQ and the rig switched back to receive. A station was calling me!

"RYRYRYRYRYRYRYRYRY KS1A KS1A KS1A DE IK2IWB IK2IWB IK2IWB PSE KKK." He unkeyed and turned it back.

I typed his call into my computer log, and my computer answered him.

"IK2IWB IK2IWB DE KS1A KS1A KKK." He introduced himself to us as Dieter in northern Italy, and said I was hitting with an RST of about a 589. I entered all of this into the computer log, and when it came time to answer Deiter my computer merged his info into the general script I had in memory.

"Nice to work you (Deiter) here on rtty. Thanks for (589) from (NORTHERN ITALY). Your RST (DEITER) is 599 from Tewksbury, MA..."

While the computer was carrying on my end of the conversation I explained to Tom that, "99 percent of the RTTY you find on the ham bands has a shift of 170 Hz and a Baud of 45. Although a few bulletin board stations operate at a higher baud rate. The monitor scope helps in finding the shift of stations outside the ham bands. Most utility stations operate with a shift of 425 or 850 Hz, and a baud rate of 75 or 100."

At the end of the automated computer-generated introductions and salutations Dieter and I manually started to chat about our other hobbies. He was very involved in magic, another interest in which we shared. He had a problem with his Toyota Selica and we compared the costs of what an Italian auto mechanic charged for repairs versus what we pay over here.

Then Tom took over the keyboard and the two typed back and forth for ten minutes or so. In the end, Tom was hooked. His hamming spirit renued with the new digital mode he had found! It turned out that he actually didn't know EVERYTHING after all. Total time for the contact, 53 minutes! A bit longer than just the usual signal report and QTH.

I hope you'll join us in the RTTY portion of the bands.

(cont'd from page 9)

How important is general coverage to you. If the the answer is "not very," consider the Omni V. It's an excellent hamband only rig that will serve you well. If you feel the need for general coverage, I'd recommend that you buy a separate all-band, all-mode receiver to compliment your ham gear. Why compromise either?

One of the really great aspects of owning a Ten-Tec is the company's support policy. If you have a problem with the rig, call for support. The company representatives are knowledgeable and friendly. In most cases, the problem can be diagnosed over the phone. Replacement parts or even entire circuit boards are sent to you on consignment so you can get back on the air quickly. I've only had a couple of problems in more than a dozen years of using TenTec rigs. Each was literally fixed within a day. That's the kind of support that builds a loyal following.

Bibliography

James Fisk, "Receiver Noise Figure, Sensitivity, and Dynamic Range--What the Numbers Mean," Ham Radio for Oct. 1975.

Robert Sherwood, "Present Day Receivers-Some Problems and Cures," Ham Radio for December 1977.

John Grebenkemper, "Phase Noise and Its Effects on Amateur Communications, Part 1" QST for March 1988.

by Mike Bryce, WB8VGE
2225 Mayflower NW, Massillon, OH 44646

★★★ The Logger ★★★

Before my first computers, I thought utilities were gas, water, and electric! And public domain was a new power company. Well I quickly found out just what utilities were and how useful some of them can be. On the other hand, public domain software just didn't do much for me. Somehow when someone mentions public domain programs, I think of check book programs and Ohm's law calculators.

Sometime ago, I was looking over the data libraries from HamNet on Compuserve. Just for the fun of it, I downloaded a program called, what else, the Logger. Released into public domain by its author, David Myers, KD2MT

Before I un-arced the program, I had a very bad feeling this was going to be just another ho-hum program. Was I ever wrong. Lets take a closer look at the Logger, 1.5.

Again, my Tandy SX was put to the task of running the Logger, but with a slight twist. I installed a RAM drive. The logger ran from the 3.5 drive, but wrote and read the files from the RAM drive. With the RAM drive, the Logger will copy the needed files back to the 3.5 drive when you save the data or when you terminate the program.

A color monitor and CGA card really add to the pleasure of running the Logger. If you have an EGA system, so much the better. The Logger will configure itself for the EGA card and monitor. If you don't have CGA, then pressing ALT M will toggle between color and monochrome screens. ALT S will shell to DOS.

Doing a cold computer boot, the RAM drive is created and all the needed files are loaded into the RAM drive. The program runs from the 3.5 drive. Soon you'll be greeted with the sign on logo.

After the Logger backs up the data to the RAM drive, you'll soon see the main screen. Unlike some programs I've seen, the Logger's main screen is clean, clear and to the point. I've seen too many programs so cute they could make the Care Bears sick.

At the main menu, it becomes quite clear to the user, the function keys are used to move about within the program. F1 Adds new records to the database, while F4 prints out the log. Pressing F1 opens up a new window on the screen, overlapping the main menu. Again, a simple, well laid out screen. Ask for help by pressing a "?". Very little needs to be explained. You enter the call of the station, Date, Frequency, Etc., Etc. Those late night DX contest can really screw up the best typist, so if you input a strange call, the Logger will take it. The Logger will not screen out bad call signs. Also, the Logger will only hold six spaces for the call sign. So, you can't enter a call like, "H4Z/W8AW." Not enough space for all the call. The Logger will give you a "beep" if you enter a strange frequency. It will accept it, but the beep will give you a hint that something is not quite up to par. You can move about the enter fields very easily, by using the Tab, backspace, or arrow keys. When entering the date, you must use the format of date-month-year. If not, the program will not be able to sort by date correctly. No big thing, but worth mentioning. You can copy a data field by pressing control "R" to copy from the last entry. This really saves a lot of retyping when entering in old log books.

When adding new records, you'll see at the top of the enter field a record number. This record number is used quite a lot in the Logger. If you want to edit a past entry, you need to know what the entry number of the record you wish to edit. Function key F2 invokes the Edit window. Say what? You don't know the record number, well no trouble, just press F5 and you'll get them all, from number 1 to the last entry. The screen displays 36 records at a time. You can go to a number if you wish or just keep pressing Enter to scan through them all. After you get the number of the record you wish to edit, go back to the edit menu and change whatever you wish.

One of the most important features of any computer logging program is the ability to look up data. The Logger can search the log by Date, Call, Frequency, and by Mode. Of course, there is not much to explain here. If you want to see all your contacts via CW, just press the proper key and enter the mode, in this case CW. The screen will display all CW contacts in the data base. You can't print out the results though. Rats!

Pressing F4 prints out the log. You can print the file to the printer, print labels or print to a file. Choosing the printer, you'll open another window. This window tells the operator the log will take up so many pages, in my case I've got 12 pages of log book. The printer choice in my Epson. You have a choice of printing only the pages you want. Instead of printing out the entire log. This is a first-class feature. You can also print sticky labels for your QSL cards. Nothing fancy, but they get the point across. You can also print a label from the edit screen by pressing a control "L".

You can sort the data base either chronologically, by Call sign, Frequency, or by Mode. The sort is very fast, due in part to the use of the RAM drive. Of course a hard drive would be a bit slower, and the use of a disk drive would be ever slower. My Tandy chugs along at 8 MHz, the Logger would really fly with a 286 or 386 machine.

The rest of the functions are very self explanatory. F6 deletes a entry. F7 gives a status on the data file. F9 saves the data to disk. And F10 terminates the program.

So then what is the bottom line? Well all in all the Logger by David Myers is slick, simple and very functional. I don't care for editing the data base by having to first look up the entry number. Getting your cards from the buro, and then having to look up entry numbers to edit the QSL field is a pain in the butt. You can have as many entries under one call as you wish. The Logger has more than enough speed for even the fastest typist when entering data. Sorting is fast and easy. No knowledge of Dbase III is needed here. If you can stand not having the computer connected to your new transceiver, enjoy a easy to use format, speed, and have no need for beam tracking, for the price of a download, you just can't beat the Logger version 1.5 from David Myers. It's a great all around logging program for any ham from Novice to Extra. An excellent way to bring the power of the computer to the ham shack.

Copies of the Logger 1.5 can be obtained from Compuserve or by writing to David Myers, KD2MT, BOX 9861, Duke Station, Durham, NC, 27706.

If you like, I can supply a copy of the program on 5.25 floppy disk for $5.

THE GEM RADIO SYSTEM...

Right after I purchased a computer for my ham shack, I immediately decided to find the ultimate logging software for my needs. What I needed was something that was MS-DOS compatible, easy to use, and most important of all, It must be very powerful! Price was important, but as it turned out that didn't become a factor. I found the GEM RADIO SYSTEM written by Antonio Salvadori, VE3NXQ.

Although there are fancier programs than the GEM system, that wasn't a concern of mine. Other programs out there will computer control the modern rigs, but since I'm using an older rig which doesn't have that capability, it wasn't important in my decision making. Maybe it would be for you. The GEM system requires a hard disk, and the amount of log entries is only limited by the amount of available disk space.

I searched all the ham mags for articles and ads for all the different software packages. I also checked all the shareware and public domain stuff. Nothing compares to the GEM RADIO SYSTEM in any price range which makes it's 35 dollar cost one of the best ham radio buys around. The GEM RADIO SYSTEM comes in four parts.

Part one is called GEMAIR, which is the logging module. This is where you type in your raw data such as Call, time, freq., date, report, comments, qsl sent etc. In most cases, GEM is smart enough to detect from the prefix which country to automatically enter. When you receive a qsl card back, you go back into GEMAIR and add the card received data. You can at this point enter a county, and add or change any and all of the information about this contact. If you have worked the station before, the previous contacts appear on your screen. This has been helpful for me to remember a particular qso. You can also do a simple state or country search in GEMAIR.

The second part is called GEMRADIO and is the "query" module of the program. It is here that GEM becomes real powerful. With a single keystroke or two, you can generate reports on the following: Counties confirmed, Unanswered direct qsls, FBDXCC, Qsohistory, Listing of all Qsos, Missing DXCC countries, Confirmed prefixes, Qsling statistics, Russian Oblasts, WAS, DXCC countries worked, and WAZ. Most of the above is self explanatory, except to say that QSOhistory makes a neat bar graph of all your qso on a month by month basis, and Qsl statistics, tell you how many times you sent via direct, bureau etc., and how many were returned, and by which method. If that wasn't enough, GEMRADIO also has a search function which you can customize. Let's say that you want a printout of all hams named Jim that you worked in New Jersey in October. Just enter a few commands into GEMRADIO and before your eyes up pops the desired info. Any of these searches may be sent to the screen, or may be printed out on many different printers. There are drivers for many of the popular dot matrix printers available. All of these searches are stored in the program for later retrieval in the "view" section. This way you don't have to run a search every time you want to consult your data.

The third module of the GEM RADIO SYSTEM is called GEMUTIL and as it's name implies, it has maintenance programs located within. An added bonus to the software is an address book database located in GEMUTIL. I haven't had the chance yet to use this feature. You can store names and address of your ham friends etc. Also in GEMUTIL is a pro-

(cont'd on page 24)

★ AMATEUR RADIO DIGITAL COMMUNICATIONS ★

An Introduction

As Digital Digest grows and circulation increases, the magazine is coming into the hands of people who have had little exposure to amateur radio - particularly microcomputer hobbyists. This article is designed to provide some basic background information on amateur radio and amateur radio digital communications. Most microcomputer hobbyists are already familiar with digital communications in terms of telephone modems and LANs (Local Area Networks). In this article, I describe amateur radio digital communications, pointing out similarities with traditional microcomputer communications whenever possible. But first, I will attempt to briefly introduce amateur radio.

Amateur Radio

Digital communications is but a small part of the world of amateur radio. Amateur radio is a worldwide hobby which provides many services to the individuals and countries that encourage its growth. There are over one million licensed amateur radio operators, including over 400,000 in the United States.

Amateur radio can be defined as radio communications between licensed stations without financial remuneration. Amateur radio operators have a wide variety of communications modes available for their use. The major modes in use today include CW (Continuous Wave or Morse code), SSB (Single Side Band - voice), FM (Frequency Modulation - voice), Television (both fast and slow scan), RTTY (radioteletype), and packet. Communications can be by line-of-sight, ionosphere reflection, satellite, or more exotic modes such as moonbounce and meteor scatter.

Radio amateurs worldwide are authorized to operate on certain frequencies just as commercial and government stations are. The frequency space occupied by amateur radio is very valuable, and the use of this space would be welcomed by commercial users and governments. Amateur radio justifies its utilization of these frequencies by providing emergency communications and contributing to the development of new communications techniques.

In the United States, a licensed issued by the FCC (Federal Communications Commission) is required to operate an amateur radio station. There are several grades of licenses available. Each increase in license grade provides additional capabilities and requires the user to pass more difficult tests to obtain the license. These tests assure that the operators are proficient enough to operate a station in the modes allowed.

Licenses

Licenses, capabilities, and testing vary from country to country. Five amateur radio licenses are available in the United States; here's a brief summary of the elements tested and the capabilities each offers.

The Novice license is the easiest license to obtain. Its license privileges were recently expanded to include voice and digital communications privileges on one HF band and several VHF and UHF bands in addition to the previously permitted CW operation on the HF bands. The testing is relatively simple: Morse code at 5 WPM (words per minute), operating techniques, and basic electronic and radio theory.

The Technician class license allows all the capabilities of a Novice plus additional VHF and UHF capabilities. The test consists of the Novice elements plus a higher-level theory test.

The General class license allows all the capabilities of a Technician plus increased operating capabilities on certain HF frequencies. The testing is the same as the Technician with the exception of a 13 WPM Morse code test. The General class is the most popular license in the United States.

The Advanced class license allows all the capabilities of a General plus additional HF frequency privileges. The testing is the same as the General with the exception of a higher level theory test.

The Extra class license is the highest class of license available. It offers all the capabilities of the Advanced class plus the highest level of HF frequency operating privileges. The testing includes all the theory elements of the Advanced class plus another high-level theory test and a 20 WPM Morse code test.

Callsigns

Every licensed operator is assigned a unique callsign. New callsigns in the United States have a different format for each license class. In the case of an upgrade, the amateur may opt to keep his or her previous callsign from a lower level license. Currently issued Novice callsigns are in the format of XX#XXX, Technician and General are X#XXX, Advanced is XX#XX, and Extra is X#XX or XX#X (where X indicates a letter and # a number). All United States callsigns can be identified by the prefix; U.S. callsigns always begin with N, K, A, or W.

The number in the callsign represents the district in which the license was issued. The United States is divided into numbered districts (0 to 9). When a licensee moves permanently to another district, he or she may keep his or her present callsign or apply for a new one with the new district number. The new callsign will not contain the same alphabetical characters as the old callsign since new callsigns are issued in alphabetical order.

Modes of Digital Communication

Now that you have a little background on amateur radio, we can discuss the various modes of digital communication that are available to amateur radio operators. Microcomputer hobbyists will undoubtedly find many of the terms and procedures familiar.

The Morse code is one of the oldest forms of digital communications. The Morse code contains most characters needed for communications. With the advent of computerized units, Morse code can be automatically sent and copied. However, the slightest bit of interference or imperfect sending can reduce the decoder's ability to accurately copy the code.

Baudot RTTY (Radio TeleTYpe) uses a form of digital coding known as the Baudot (or Murray) code. In the Baudot code, each character is made up of five levels (commonly called the mark and space elements). However, there are only 32 possible combinations using a five level code. Therefore, the Baudot code includes two different character sets, figures and letters; the character sets are alternated as needed.

ASCII RTTY was first legalized in 1980 by the FCC for amateur use in the United States in response to the wide proliferation of computer equipment which uses the seven element ASCII code. ASCII's primary advantages over Baudot RTTY are its speed (ASCII is usually sent much faster than Baudot) and its 128 possible characters. In operation, ASCII RTTY is very similar to Baudot RTTY except for the coding used.

AMTOR (AMateur Teletype Over Radio) was first legalized for amateur use in 1983. AMTOR uses a special coding in which there is a constant radio of mark and space elements (more of this later). If the received characters do not have the proper ratio, they are presumed erroneous. Because of this error checking, AMTOR is much more reliable than standard Baudot or ASCII RTTY.

(cont'd on next page)

(cont'd from previous page)

Packet is the most advanced form of digital communications available to radio amateurs. The primary advantages of packet radio are speed, networking, error checking, and efficient use of frequency space. Packet radio operates using a standard digital communications networking technique known as Carrier-Sense Multiple Access with Collision Detection (CSMA/CD). Put simply, this means that a packet station will not transmit when the frequency is busy. It will wait until the frequency is clear and then transmit a short burst (frame) of information. Because packet transmissions are very short, many packet stations can be on the same frequency without interfering with each other. A line of text that takes 30 seconds to type can be transmitted in a fraction of a second.

Packet is very similar to many advanced forms of micro, mini, and mainframe networking. In fact, the AX.25 protocol used in amateur packet radio is based on the commercial X.25 protocol. Microcomputer hobbyists with an interest in networking schemes will feel right at home with packet.

Digital Communications Basics

Any amateur radio digital communications station must have three basic components: a terminal, an "interface", and a transceiver. The "interface" can take several forms that are discussed later. The terminal converts characters into digital codes and vice versa. The interface converts digital signals into analog tones and vice versa. And finally, the transceiver transmits and receives the analog tones.
When transmitting, characters typed on the keyboard of a terminal are converted into digital codes which are sent to the interface. In the interface, the digital codes are converted to analog signals which are sent to the transmitter. The transmitter then transmits the analog signals.

At the receiving end, the receiver receives the analog signals and sends them to the interface where they are converted back into digital codes. The digital codes are then sent to the terminal where they are converted back into characters which are sent to a display, printer, or other device. Either way, digital codes, analog signals, and conversions are involved.

This system is similar to landline (telephone) modems connected to microcomputers. The modem is the interface, and the telephone line takes the place of the transceiver. In fact, most amateurs use microcomputers running terminal emulation software as terminals.

To learn more about the mechanics behind amateur digital communications, we'll use RTTY as an example for the next several paragraphs. RTTY is the easiest to understand of the advanced forms of amateur digital communications. The same basic principles can be applied to AMTOR and packet.

There are two standardized digital codes in use in RTTY: Baudot (Murray) and ASCII - American Standard Code for Information Interchange. The Baudot code is the most common in terms of use (not because it is more sophisticated but because it has been in use for so long). The Baudot code is a five level code and ASCII is a seven level code. Allow me to explain what that means.

In the binary system, there are only two states, represented by 0 and 1. The binary system is used extensively in digital communications. The two states can be represented by two different voltages, currents, or frequencies. In order to represent more than two different conditions using the binary system, bits must be combined to increase the number of possible conditions.

For example, one bit (Binary digIT, a 0 or 1) is sufficient to indicate if a light is on or off. However, to represent more complex concepts such as the number system or alphabet, several bits are combined. If two bits are used, four different conditions can be indicated. Since the alphabet has 26 different characters, five bits must be combined for a total of 32 different possible characters.

The most common digital code in use in RTTY is the Baudot code, a five level code. Each character is represented by a digital code five bits long. However, there are only 32 possible combinations using a five level code. Therefore, the Baudot code includes two different character sets, figures and letters; the character sets are alternated as needed. The ASCII code is a seven level code. Using seven bits, there are a total of 128 possible combinations. This eliminates the need for two different character sets.

Once these binary combinations are generated (whether by a mechanical teletype, microcomputer, or some other device) they are sent to a modem (MOdulator DEModulator), often called a Terminal Unit (TU) , a RTTY or AMTOR only "interface". This device generates (modulates) tones (frequencies) which correspond to the state of each bit for transmission over an analog medium, such as a radio link. The two tones are given special names. The tone corresponding to the binary 1 is called the mark and the tone corresponding to the binary 0 is called the space. This terminology dates back to the early days of telegraphy when an automatic receiving device would lower a pen on a strip chart when a signal was present making a mark; of course, when there was no signal the pen would not touch the strip of paper and a space would result. These tones are then transmitted by a radio transmitter to the receiver(s) where the tones are converted back into digital signals (demodulated) by another modem.

These processes are transferrable to AMTOR and packet as well. A packet only "interface" is called a Terminal Node Controller (TNC). There are also multi-mode "interfaces" that are capable of operating CW, RTTY, AMTOR, and packet. These multi-mode units are very popular today and allow easy experimentation with all modes of digital communication.

Conclusion

Hopefully, I've piqued your interest in amateur radio digital communications. With the information presented in this article, you should be better able to understand some of the other articles published in Digital Digest. Digital communications with amateur radio has many similarities with landline and hardwired microcomputer communications. If you are already well versed in microcomputer communications, you should have an easy time making the transition to amateur radio.

To learn more about getting your amateur radio license, I suggest contacting the American Radio Relay League at 225 Main Street, Newington, CT 06111 or the National Amateur Radio Association (see ad below.) While a novice class license will allow you to gain some exposure to digital communications, a technician will allow you even more, and a general will permit you to operate all of the modes. Feel free to write me or Digital Digest if you have any questions or suggestions for future topics that would interest you.

de Jonathan Mayo, KR3T

by Jonathan L. Mayo, KR3T
3908 Short Hill Drive • Allentown, PA 18104

★ Computer Viruses: Part 2 ★

Thus far, the discussion on distributing programs has been limited to the floppy disk, and the same controls already discussed apply to other forms of media as well. Another means of distributing programs is telecommunications.

Telecommunications is the transfer of data between separate computer systems without the need for exchange of physical media. In the personal computer world, telecommunications usually refers to connecting your computer to remote computer systems over the telephone with a modem.

There are two classes of remote computer systems - bulletin boards and information services. Bulletin boards are usually personal computers that are connected to the telephone service via a modem. Other personal computer users who connect to the bulletin board can upload and download programs and other files and leave messages for other users. Information services are large remote computer sites, usually using mainframes and other large computer systems, that can handle thousands of simultaneous users that connect over the telephone lines. Information services have hundreds of thousands of programs and other files available for downloading, feature an extensive electronic mail system, and have large databases available for searching.

Bulletin boards are usually run by individuals or user's groups, and there are thousands of bulletin board systems spread across the nation and the world. The quality of a bulletin board depends almost entirely on the system operator, or SYSOP, that manages it. Many shareware, freeware, and public domain programs are available for downloading from the bulletin board. In addition, users can upload their own programs to the bulletin board for other users to download.

Typically, there is no fee for using a bulletin board other than the long distance charges necessary to call it. At most, ten or so users can be connected simultaneously. From a perspective of protecting your system from virus-type programs, you should approach bulletin boards with care. Contact the system operator to see if he screens uploaded files for Trojans, worms, or viruses. If not, it is probably best not to download any programs from that bulletin board.

Information services are run by corporations. Three of the biggest information services are CompuServe, Genie, and the Source. There are usually local telephone access numbers near major cities in the United States, so a toll call is usually not necessary to access them. However, information services do charge an access fee for their use.

Information services also contain a large number of shareware, freeware, and public domain programs. It is much safer to download these programs from an information service than a average bulletin board because the information service screens all uploads. There are one or two cases where people downloaded programs containing viruslike programs from an information service, but the problem was quickly discovered and the offending programs removed.

Regardless of whether you download a program from a bulletin board or an information service to your computer, the same precautions apply as with floppy disk based programs. If you save the downloaded program to a clean disk and the program itself is clean, you won't have any problems. Should the program contain a virus-type program, your system is still not in danger of infection unless you execute the program, triggering the virus-type program.

The bottom line is to make sure you obtain the programs you run on your computer from the most reliable source possible. That is the best way to make sure you don't get a virus-type program in your computer. Commercial or shareware software ordered directly from the company or author is the safest way to obtain software (other that writing it yourself). Next comes legal copies of non-commercial software obtained from a trusted person who has been using the software without incident for several months. Finally, software downloaded from information services and reputable bulletin boards will probably be fine. Avoid, at all costs, illegal copies of commercial software and other programs from unknown sources.

Defensive Action

Even assuming that you follow all of the suggestions in the previous section, it is still possible, however remote, for your personal computer to get infected. This section discusses numerous useful ways to minimize the damage that a Trojan horse, worm, logic bomb, or computer virus can do to your computer system.

The best advice I can give you up front is to know your system. Know what files are stored on your hard drive. Know what type and version of operating system you are using. Observe your computer in action. How long does it normally take to start up? ...to load a particular program? ...to respond to commands? Find out how much free disk space you have and monitor it. In general, get to know your computer as best you can. That way, you'll know when it starts to act strangely - even minute changes. Like cancer, if you observe a problem in its early stages, it is much easier to fix.

The very first thing you should do to defend yourself against a future attack from a virus-type program is to backup your programs and data. That way, should your hard drive be reformatted or your floppies corrupted, you can still recover with little trouble. There are many different methods of backing up. For floppies, simply make duplicate copies. In the case of a hard drive, use floppies, tape, or some other form of backup. Make regular backups and keep complete backups going back about six months. That way, should you get infected by a virus and not notice it for a few months, you can restore from an uninfected backup.

The next thing you should do is to write protect all your original factory master disks. This will prevent the computer from ever storing information on them. To write protect a 5-14 inch disk, cover the write protect notch with a write protect tab. With 3-1/2 inch disks, open the sliding tab so that you can see through the tiny square opening. Never use master copies for everyday work; only use them for making copies.

If you boot your computer from floppies, make a clean boot disk with the write protected factory master operating system disks. Then write protect the new boot disk also. Only use that boot disk to boot the system. Do not boot the computer with another floppy. This will eliminate the possibility of your booting from a disk with an infected operating system.

If you have a computer that boots off the hard drive, do not boot off of a floppy unless you are sure it is clean. The best way to do this is to configure the disk yourself using write protected factory master copies of the operating system. And when you install the operating system on your hard drive, make sure you use the write protected factory master copies. The same rationals in the previous paragraph apply here.

Reboot the computer between running programs, especially games. This will, depending on the system, reset the computer's memory and reload any memory resident operating system programs from the disk. Otherwise a virus or worm might remain in memory,

(cont'd on next page)

(cont'd from previous page)

ready to attack the next program or data loaded into memory. Also, reboot before and after formatting disks for an extra measure of safety.

Monitor the usage of your computer. If other people use your computer, make sure they do not use any disks that you haven't already checked out. Make sure the users of your computer understand the virus problem and the steps you have taken to protect the computer.

Be very careful when running new software for the first time. Make sure there are no other disks in the drives. Run the program from floppies if at all possible. This way, should the program have a Trojan or virus, it might not spread beyond the disk it is stored on.

Always monitor your computer system carefully when running new software. Read the documentation thoroughly before starting the program. Make sure there are no extra files on the disk that do not belong there. Some software documentation lists the names and sizes of all the files included in the package. If so, compare the files on your disk to the ones listed. If they don't match, don't run the program.

If a program comes without any documentation, be extremely wary of it. Look for a help or text file on the disk. If there is not one, and you cannot locate the name and address of the author, distributor, or company, don't run the program. Any decent program will have at least minimal documentation, and the author or company will be prominently displayed somewhere in the files.

A big clue to whether a program is really what it says is the size of the program. If you have what is supposed to be a full featured word processor, and the program is only 5,000 or so bytes long, something is very wrong. Also, look at the file creation date. If it is far in the past or future, something may be wrong. Should you decide to run these programs, be very cautious.

A more tedious thing you can do to protect your system is to keep tract of the creation data and size of files on your disk. Should the size and/or date of an executable file change, it is possible that it has been infected. You can also compare files with their equivalent on the write protected master copies of your programs.

Should you use your computer for business, there are a few additional precautions that you might want to take. At the risk of taking the "personal" out of personal computers, you could simply eliminate the use of public domain, freeware, and all but very well known shareware programs. In addition, you can simply never download programs from bulletin boards. Another good rule is to never play computer games on your work computer. Just stick with several commercial packages to play it as safe as possible.

On the Offensive

Ok, you're sure you've been infected by a virus, or that a Trojan horse has been triggered on your personal computer. What now? The first thing you should do is make sure that what you think is the handiwork of a virus-type program is not actually a buggy program, malfunctioning hardware, or user error. Sometimes its very obvious that you've been hit by a virus-type program - if a message to that effect pops up on your screen, for example. Other times, it can be more subtle.

If, after rationally examining the situation, you are still sure you have been hit, its time to plan a recovery strategy. Can you pinpoint exactly when the virus, Trojan, or worm entered your computer? For example, has your computer started acting strangely since you played that new game you downloaded Friday night? If so, make sure you restore using data backed up previous to the attack. If you can't determine when the computer was infected, use the oldest backups you have for safety's sake.

The next step is to determine the extent of the damage. Are all the drives infected? Just the floppy containing the program? What floppies did you put into the computer after you believe it was infected? Be very liberal about all of the answers. It's much better to fix too much than too little. And unless you're an experienced computer user, don't plan on trying to repair the infected disks; just reformat them and re-copy clean copies of the software and files back onto them.

Most viruses only infect executable programs, not text or other nonexecutable files. It may be possible to copy the nonexecutable files off the infected disk and re-use them. Use a word processor or text editor to check the files for damage. If you're dealing with a worm or other data altering program, don't try to re-use anything.

(cont'd on page 24)

(cont'd from page 19)

gram that will print out a chart of bearings and distances to every current DXCC country. GEM currently has all 320 countries. Updates will be made available in the future. The last feature of GEMUTIL is a SWL report generator for sending qsls to swls that send reports.

The fourth module of the GEM system is called GEM CONTEST. This obviously is the contesting section of program. You can choose to log in real time, using the computers built in clock, or you can type in the date and time. This is a simple contest logging setup, as the author of the program admits in the users manual. Currently the program is set up for the ARRL International DX contest, Asian DX, CQWW DX, CQWW WPX, CQWW RTTY, and the CARA contests. More contests will be added in the future. Antonio wishes feedback as to what additional features and contests he should include (I would like to see the ARRL sweepstakes added). One very important aspect of this program is it's ability to integrate the contest data into the regular database after the contest is over! In many other systems you must retype all your data into your main logging program.

There is also a qsl label printing program. As you make contacts and decide that you want to send a qsl, A separate qslfile is created. Later on you can set up your printer with labels, run this program, and it will print very nice qsl labels that are four inches long by one and a half high. The fault I find with this feature lies in the fact that if you later decide to send qsl's to stations for any reason, there is no way to get this data into the qslfile. In other words, if you don't initially decide to send a card, then you cannot print a label if you change your mind later. Hopefully this will be changed for version 6.

All in all, I have found the GEM RADIO SYSTEM to be a very useful tool in my shack for all of my radio work. For the price of 35 dollars, you get a very powerful piece of software, and a decent printed manual with tutorial that is pretty easy to follow along. It is very user friendly and more powerful than I had ever expected to find. The GEM RADIO SYSTEM is available from : Antonio Salvadori VE3NXQ, 17 Colborn Street, Guelph, Ontario, Canada, N1G 2M4.

de Ken Van Tassell, N1FYF
18-C Gilmore Street
Lowell, MA 01854

(cont'd from page 23)

Turn your computer off for at least five minutes, then reboot using a clean, write protected copy of your operating system. Now reformat all affected disks.

Be careful not to run any programs on any of the infected disks, and make sure all disks you put in the drives are write protected. Once the disks are formatted, turn the computer off again for at least five minutes before booting up again. Now you can restore files to the reformatted disks using write protected originals.

If you know how you were infected, notify the source of the program. And be sure never to use that program again. A computer virus or Trojan attack can be nerve-racking, especially if you use your computer for business. The best defense against virus-type programs is thorough backups. That way, should you get attacked, you can restore back to before the attack.

EDITOR'S NOTE:
If you have news and information of interest to the digital amateur radio community... please let us know!

Between The Ham Bands...

Short wave excitement only begins on the ham bands!? Ever tune your receiver outside those amateur boundaries and wonder what really goes on there? Every issue we'll try to whet your appetite.

"ZCZC...CAN YOU HAVE 14 MORE CASES OF DOM PERIGNON WAITING FOR US IN LISBON? SUPPLY RUNNING UNEXPECTEDLY SHORT HERE. MANY THANKS, R.Z."

Wow! This is exactly what just printed out before me in AMTOR as I sat down to write this column. While Amateurs have been tuning AMTOR on the ham bands for quite a while now, most have never even thought about looking elsewhere for AMTOR. Boy, what they're missing on those other mysterious parts of the short-wave spectrum! Tune your receiver to the area of 12.470 thru 12.530 and listen for the continuous AMTOR "pulses". Using only your receiver and the same TNC you or a friend may own for AMTORing on the ham bands you will find ships calling their home offices all over the world for supplies, passenger lists, warnings about troublesome passengers and much, much more! Just remember that you may listen..but it's against the law to divulge this private traffic! Look for more AMTOR from 6.570 thru 6.630 and many other places from 2-30 MHZ!

If you need a Radio Denmark QSL card... get your reception report in right away as their QSL department becomes a thing of the past on June 1st, 1989... WCSN, the Christian Science Monitor station broadcasting on short wave to the world from Scotts Corner, Maine is NOW ON TV! The world service programs are being aired on their owned and operated TV Channel 68 in Boston each morning at 0600 to 1000 UTC! Since TV audio is FM, it's a rare chance to hear a SW station with perfectly clear audio. And you should hear that interval signal!... For more info on these and other late breaking media events I HIGHLY RECOMMEND listening each week to Radio Netherland's MEDIA NETWORK hosted by Johnathon Marks. Since this column is printed on computer bulletin boards and newsletters around the world I can't give you all of RN's frequencies... but the program gets several airings on Wed's & Thursdays. A MUST HEAR! Another milestone in the US/USSR warming came as Miles, KA1RRW just worked the soviet MIR space station on 2 meter FM using his wits, 160 watts, and his regular old rooftop 11 element beam! It seems that you can monitor the MIR station on 143 MHZ just below the 2 meter ham band as they conduct official business with their ground stations in CUBA and the Soviet Union. When you can hear them, THEY'RE IN RANGE OF YOU! Miles turned his beam until he got the strongest level on the space to ground communications and then called the MIR station on another assigned frequency inside the 2 meter ham band... THEY ANSWERED! While the crew is now back on earth, a new MIR crew will be orbiting in just a few short months. Watch this column for the exact frequencies of the next mission!

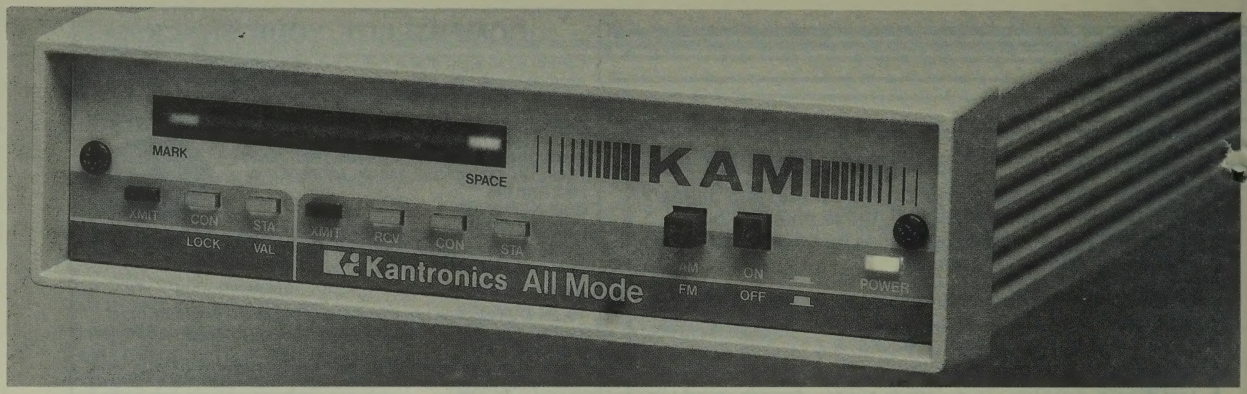
de Jim Mulvey KS1A / Billerica Amateur Radio Society

Is It Time To Renew Your Subscription!?

Be sure to check your mailing label for your subscription's expiration date. Expiration is indicated by the digits to the right side of your name by YEAR-ISSUE#. Issues are numbered 1 through 6 and relates to the publication as follows:

(1)Jan/Feb, (2)Mar/Apr, (3)May/Jun, (4)Jul/Aug, (5)Sep/Oct (6)Nov/Dec.

EXAMPLE: If your mailing label has the digits "89-6", your subscription will expire in 1989 with the Nov/Dec issue. To insure uninterrupted service, be sure to mail in your renewal before mailing of the next issue (approx. the 25th of the first month's issue date - ex: Jan/Feb is mailed on the 25th of January).



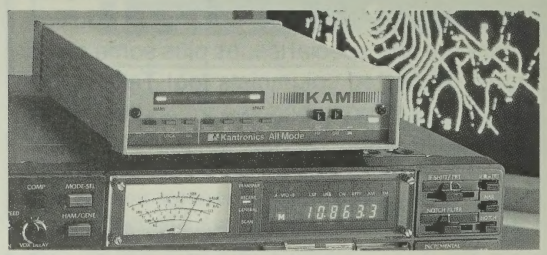
If You Want the Most Advanced TNC Today...

In 26 countries around the world, tens of thousands of amateurs know that Kantronics is the leader in bringing tomorrow's technology to their stations today. They also know they will always be among the first to incorporate just-introduced features and modes with Kantronics software and firmware updates.

And, they know that Kantronics is unique in its ability to seek out, develop and incorporate the most advanced features into each of five different TNC models before anyone else. Why? Because every program Kantronics writes, and every unit Kantronics designs and produces are born right here at the factory in the U.S.A.

Meet Your Mailman

In this age of telco LANS, E-mail and FAX,



PBBS is just one of the firsts Kantronics delivered.

you will know you have mail in your **Personal Packet Mailbox™** when your KAM "STA" LED is blinking. New firmware level 2.85 has also added a handy automatic mailbox user-connect. So save your computer and monitor life by turning them off when you are away, and never miss a beat on the airwaves.

Version 2.85 KAMs have increased Packet Cluster™ compatibility, **KA-NODE™** path preservation, KA-NODE recognition of the "NET" nodes and HF baud rates from 50 through 300! And there are three new mailbox commands: *List Mine, Read Mine* and *Kill Mine.*

and Tomorrow...

Will the Real Dual-Port Please Stand Up?

Read our lips. **The KAM™ is the only true dual- port when it comes to packet.** Your Personal Packet Mailbox™ is accessible from both HF and VHF! Version 2.85 has dual-port compatibility with RLI/MBL boards and KISS mode for both ports. You can monitor HF and VHF packet operations at the same time. Users can even gateway from HF to VHF (or in reverse) through your KAM.

Kantronics **All-Mode™** (KAM) has Packet, WEFAX, ARQ, FEC, RTTY and CW reception. But we have five models to suit your particular taste. **Ask your dealer for the best choice today...and tomorrow.**

Kantronics
RF Data Communications Specialists

1202 E. 23rd Street Lawrence, Kansas 66046
(913) 842-7745

★ Publication & Subscription Information ★

Digital Digest is published bi-monthly on, or about the 25th of the first month's issue date.

Opinions expressed are those of the article's author and not necessarily those of Digital Digest. The publisher assumes no responsibility for errors or omissions and assumes no liability for same.

★ SUBSCRIPTION RATES ★

$16.00 U.S. / **$22.00** Foreign

Single Copy: $2.75 U.S. / $4.00 Foreign

— Payable in U.S. Funds Only —

Subscriptions should be mailed to:

Digital Digest
4063 N. Goldenrod Road
Winter Park, Florida 32792
TEL: (407) 671-0185 • FAX: (407) 671-0194
CompuServe I.D.# 73330,1335

The purpose of the Digest is to provide useful and timely information on all modes and aspects of amateur digital communications, computers and software.

Please submit letters, articles, club newsletters and other editorial material to: **Digital Digest**(Editorial Deptartment)
4063 N. Goldenrod Road • Winter Park
Florida 32792

Get Connected With Digital Digest

Please fill out and mail with payment (U.S. Funds: Check or Money Order): ***$16.00*** *U.S. /* ***$22.00*** *Foreign*

Please check if NEW ☐ or RENEWAL ☐

Name _____ Call _____

Address _____

City _____ State ____ Zip _____

Favorite Modes _____

Special Interests _____

_____

Ham Station (Gear) _____

_____

Occupation _____

Please mail to: **Digital Digest,** 4063 N. Goldenrod Road, Winter Park, Florida 32792

Published by: ARVO & ASSOCIATES, INC. • Winter Park, FL

ICOM

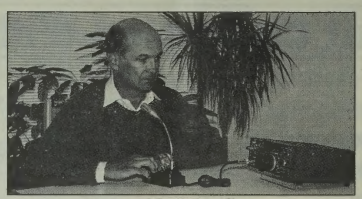
IC-735 HF Transceiver
With One
Year Warranty!

ROCK SOLID

"The seven IC-735's used at P4ØV performed well. Their excellent dynamic range contributed to our victory at P4ØV. The IC-735 is a true champion!" Dale Green, VE7SV

ICOM's IC-735 is the world's most popular HF transceiver for three simple reasons: **Performance, Size and Reliability.** With the highest performance, smallest size, and best customer satisfaction of any HF transceiver, the IC-735 is the undisputed champion for fixed, portable or mobile operations.

- **Field Proven 100W Transmitter** with 100% duty cycle. Proudly backed with ICOM's full one-year warranty.
- **105dB Dynamic Range Receiver** includes passband tuning, IF notch, adjustable noise blanker, and semi or full CW QSK.



- **Conveniently Designed.** Measures only 3.7"H by 9.5"W by 9"D. Great for mobiling or portable operation!
- **Optional AH-2 Automatic Tuning Mobile Antenna System** covers 3.5MHz-30MHz.
- **All HF Amateur Bands and Modes** transmits all U.S. HF amateur bands. General coverage receiver.
- **12 Tunable Memories** operate and reprogram like 12 separate VFO's. Supreme flexibility!

Additional Options: SM-8 or SM-6 desk mic, PS-55 AC power supply, AT-150 automatic antenna tuner for base operation.

ICOM's IC-735. . . the radio with the rock solid reputation! See it today at your local ICOM dealer.

ICOM America, Inc.,
2380 116th Avenue N.E., Bellevue, WA 98004
Customer Service Hotline (206) 454-7619
3150 Premier Drive, Suite 126, Irving, TX 75063
1777 Phoenix Parkway, Suite 201, Atlanta, GA 30349
ICOM CANADA, A Division of ICOM America, Inc.,
3071 - #5 Road, Unit 9, Richmond, B.C. V6X 2T4

ICOM
First in Communications